SCIENTIFIC AMERICAN

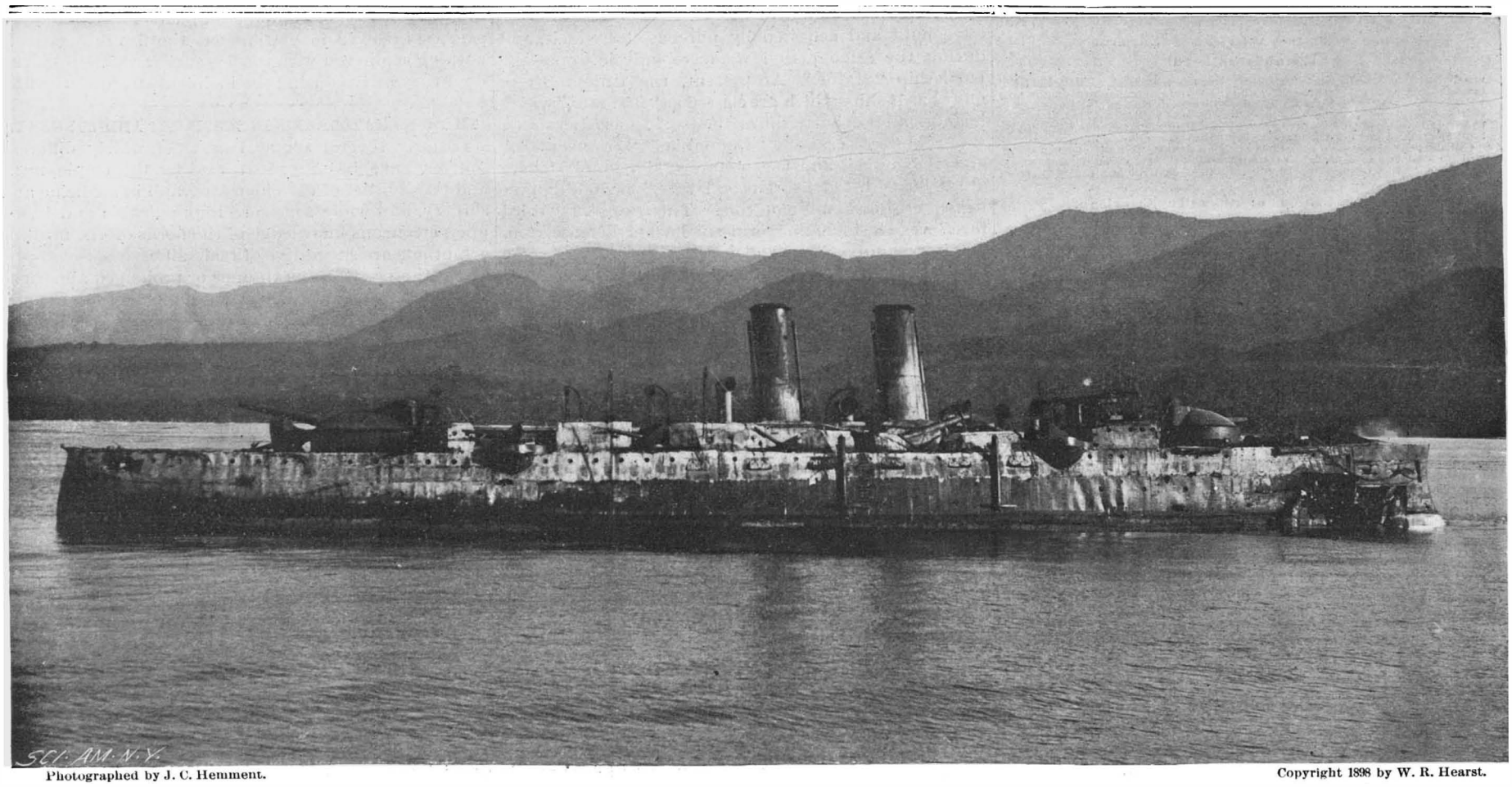
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1898, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY, AND MANUFACTURES.

Vol. LXXIX.—No. 5.
ESTABLISHED 1845

NEW YORK, JULY 30, 1898.

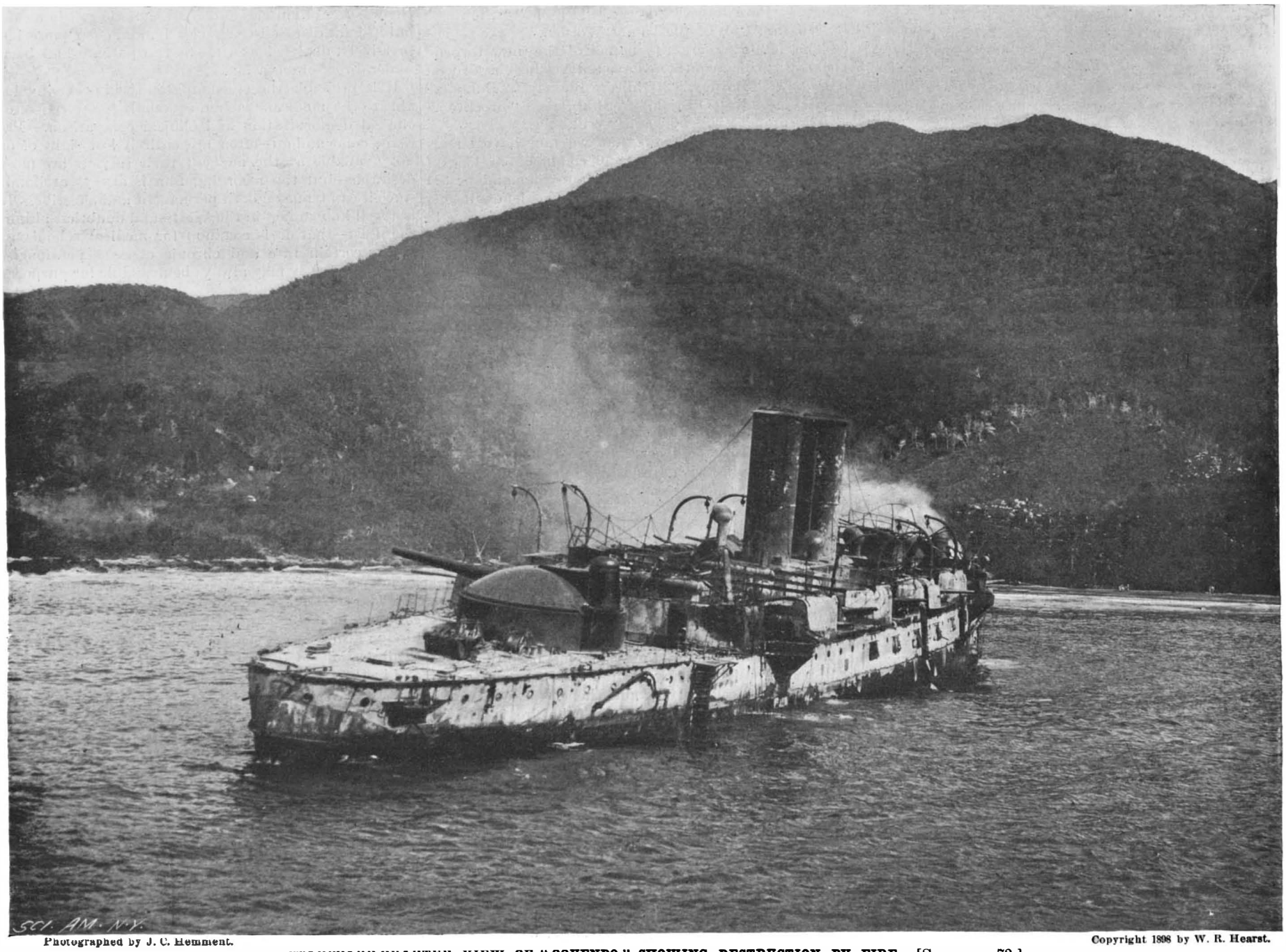
[$3.00 A YEAR.
WEEKLY.



Photographed by J. C. Hemment.

Copyright 1898 by W. R. Hearst.

WRECK OF THE "VIZCAYA," SHOWING OPENING AT THE STARBOARD BOW, CAUSED BY EXPLOSION OF HER OWN TORPEDO.



Photographed by J. C. Hemment.

Copyright 1898 by W. R. Hearst.

STARBOARD-QUARTER VIEW OF "OQUENDO," SHOWING DESTRUCTION BY FIRE.—[See page 72.]

© 1898 SCIENTIFIC AMERICAN, INC.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....**$3.00**
One copy, six months, for the U. S., Canada or Mexico..... **1.50**
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. **4.00**
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

The Scientific American Supplement

(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year for the U. S., Canada or Mexico. $6.00 a year, or £1 4s. 8d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries, *eight dollars and fifty cents a year*, or £1 14s. 11d., postage prepaid.

Building Edition of Scientific American.

(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders, and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign countries, $3.00 a year, or £0 12s. 4d. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign countries, $6.50 a year, or £1 6s. 9d. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN, and SUPPLEMENT, $9.00 a year. To foreign countries, $11.00 a year, or £2 5s. 2d., postage prepaid.

Export Edition of the Scientific American

(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, or £0 12s. 4d., postpaid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JULY 30, 1898.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1178.

For the Week Ending July 30, 1898.

Price 10 cents. For sale by all newsdealers.

THE PRESENT STATUS OF THE UNITED STATES NAVY.

The Navy Department has just issued a very instructive pamphlet, dated July 1, which gives the list and stations of the officers as well as the full list of all of the vessels in the navy, including those which are building and those which have been acquired. An examination of the tables shows that we have at present 301 vessels, of which 236 are available for war purposes, the rest being unserviceable or under construction. The "Registry of the Navy of the United States," which was published on January 1, 1898, listed only 141 vessels, of which 109 were available for service, so that in the few months which have intervened between the destruction of the battleship "Maine" we have built and acquired by purchase 126 vessels, and during the same period we have only lost one—the battleship "Maine." At present, the United States navy has 11 ships which are classed as "first rate," which includes all the battleships, the two armored cruisers, the protected cruisers "Columbia," "Minneapolis," and "Olympia," and the monitor "Puritan." There are 18 boats listed as "second rate," including protected cruisers and monitors. There are 22 "third rate" vessels, including cruisers, harbor defense ram, monitors, gunboats, and dispatch boats. There are 6 vessels under "fourth rate," including the dynamite cruiser "Vesuvius" and gunboats and cruisers. We have now 36 torpedo boats built and building and authorized, but in some cases the contract for them has not yet been awarded. We have 12 tugs, 6 sailing ships, 5 receiving ships, and 12 vessels which are unserviceable. There are 33 vessels under construction exclusive of the torpedo boats, but including the torpedo boat destroyers. We have 38 auxiliary cruisers and yachts, which include the formidable "Harvard," "Yale," "St. Louis," and "St. Paul." We have 33 steamers and colliers, used for supplying coal and provisions and for transport steamers, ambulance ship, supply ships, repair ship, etc. We have 27 tugs and 15 revenue cutters, as well as 4 lighthouse tenders and 2 Fish Commission vessels, but the latter two classes will not prove of much avail in the present war, although the lighthouse tender "Mangrove" has distinguished herself. It is noticed that the three first-class battleships for which contracts have not been awarded are to be named "Maine," "Missouri," "Ohio." The names of the new 2,700-ton monitors are to be "Arkansas," "Connecticut," "Florida," and "Wyoming." The new new torpedo boat destroyers will be named "Bainbridge," "Barry," "Chauncey," "Dale," "Decatur," "Hopkins," "Hull," "Lawrence," "Macdonough," "Paul Jones," "Perry," "Preble," "Stewart," "Truxtun," "Whipple," and "Worden."

The following are the names of the new torpedo boats for which contracts have not yet been awarded: "Bagley," "Barney," "Biddle," "Blakely," "DeLong," "Nicholson," "O'Brien," "Shubrick," "Stockton," "Thornton," "Tingey," and "Wilkes."

The list of officers shows that we now have 7 rear-admirals on the active list; 10 commodores, 45 captains, 85 commanders, 74 lieutenant-commanders, 325 lieutenants of all grades, 170 ensigns, 70 chief engineers, 66 passed assistant engineers, 52 assistant engineers, 18 naval constructors, 19 assistant naval constructors, as well as 15 civil engineers. The information which the pamphlet conveys regarding the officers is, of course, very slight, but we notice under "Present Duty or Station" Richmond P. Hobson, "prisoner from 'Merrimac.'" The "Expiration of last cruise or tour of sea service" being "May, 1898." Under "Civil Engineers," "Leave of Absence" is placed opposite the name of Robert E. Peary.

LONDON'S FIRE SYSTEM REVOLUTIONIZED.

Commodore Wells, R.N., chief officer of the Metropolitan Fire Brigade, has seen fit to revolutionize the system of dealing with fires which has been in vogue in London for thirty years past. The old system offered great opportunities for a fire to attain considerable headway before it could be checked. It is pleasing to note that the total inadequacy of the old system has been seen at last and steps have been taken to remedy it. For fire purposes London is now divided into five districts, each of which has a superintendent's station and local headquarters. Every outlying station is in telephonic connection with its district headquarters. In past years the system has been that on a call being received at any station it is transmitted to the district headquarters and thence to Southwark, and directly the actual character of the fire is known the process is repeated. In the event of a very large fire, the authorities at Southwark have directed the attendance of what additional aid may be deemed to be required. The chief officer has now issued an order which announces that each station officer should be acquainted in his particular area with the nature and distribution of the buildings, fire risks, water supply, etc. This officer should in ordinary cases arrive first on the ground, and he is to have charge of the engines, ladders, and other appliances, and to send away messages as to the help required.

The fires are divided into three classes: "home calls," which include the fires which the station officer can manage himself; "district calls," which include all those fires which the nearest engines the superintendent can send on will be clearly able to manage; and "brigade calls," which include all those fires which will probably require the special attendance of a number of men and engines to be detailed from headquarters. As far as it goes, the new system seems to be practical, but at the same time the American system of sending out one or more full sets of fire apparatus with the full complement of men to every fire is far preferable. Every second counts in a fire, and often not only the safety of those in the building, but thousands of dollars' worth of property can be saved by the prompt response of a number of men. The trouble and expense involved in getting out the fire apparatus is nothing compared with the execution which they can do if they arrive during the incipient stage of the fire.

THE CINEMATOGRAPH IN MEDICINE AND SURGERY.

Latterly several suggestions, from widely different sources, have been made regarding the employment and possibilities of the cinematograph in medicine and surgery, and while some are impracticable and based upon erroneous knowledge of the needs of the medical art, others are suggestive of real value.

For the study of continuous or prolonged abnormal acts and movements, such as the action of muscles during choreic, strychnine, or tetanic spasms, the modifications exhibited by certain reflexes, etc., it may be imagined the instrument can be made readily available; here its limitations are chiefly those bounded by the experience of the operator, or the initial expense entailed by the instrument itself. Again, contrary to general opinion, it is not necessary—not even essential—that all acts should be the result of a single continuous exposure, for the action of the instrument may at any time be interrupted, for hours or even days if desired, and again set in motion. Thus the cinematograph may be used for the purpose of recording and studying the development of rapidly growing neoplasms.

Recently, in London, England, Dr. Parchen exhibited some unique results thus obtained in a case of locomotor ataxia (tabes dorsalis). The inability to stand with the feet together and the eyes closed, and the typical ataxic gait, were demonstrated in a most remarkable way. Equally clearly depicted were the inco-ordinate movements of a patient suffering from partial paralysis; especially well demonstrated was the peculiar wasting of muscles which it is practically impossible to portray by means of ordinary photographic processes. Again, the wasting of muscles and characteristic gait in a case of hip-joint disease were as clearly, and even more impressively, depicted as though the patient had been under direct observation.

It is probable the cinematograph will prove invaluable to the medical teacher, especially for purposes of clinical demonstration and clinical comparison. Patients come and go—often are entirely lost sight of or not available at the moment their services are most desirable—but the recording film is always at hand, since it can be made both permanent and effective. It is a well-known fact in the West—and doubtless also in the East—that it is common for medical schools to retain certain rare and chronic cases as pensioners, merely that they may always be available for purposes of clinical demonstration.

Dr. Fincham, in a communication to The Amateur Photographer (London), points out that the field of the cinematograph, as regards medicine and surgery, is "rich in potentialities;" that just as the discovery of the Roentgen rays first appealed to the wonder-loving public as a scientific curiosity, and now is deemed an essential part of the armamentarium of every hospital, so in the future will this instrument be regarded as a necessity for the pictorial record of suitable cases.

Nevertheless, the cinematograph at present leaves much to be desired as regards accuracy; satisfactory records cannot be had of the finer movements, owing to the flickering of the pictures; but there is little doubt the deficiency will, in the near future, lead to the adoption of mechanical contrivances that will permit of steady impressions. One great advantage offered, even at present, is that films recording unique cases can be made permanent, and so preserved indefinitely; also they can be transmitted easily and safely to all portions of the globe for purposes of illustration and instruction.

PRINTS AND LABELS.

BY PERRY B. TURPIN.

Prints and labels are interesting, if for no other reason, because, unlike other subjects of copyright protection, they are not under the control of the Librarian of Congress; but jurisdiction over them is conferred by Section 3 of the Copyright Act of June 18, 1874, upon the Commissioner of Patents.

Since the decision in 1893 in ex parte Heinz Company, 62 O. G., 1064, the right of registering prints and labels has been recognized, and the distinctions between the same have been well defined; but it is believed, from the limited extent to which the power to register prints

© 1898 SCIENTIFIC AMERICAN, INC.

is availed of by the public generally, that the right of such registration is not, to any considerable extent, understood, and that the privilege is not to a proper degree appreciated.

Prints and labels are alike as to requisites for registration: they must both have artistic merit, and a print or label which is merely descriptive in words of the article or the contents of the article to which it is applied or to which it relates, involving nothing beyond the skill of a typesetter, is not proper subject matter for registration. But, if the label or print has artistic merit, it may be registered, if properly applied for. This requisite of artistic merit is essential to the registrability of both prints and labels; but in the respect of use, prints and labels differ.

The Patent Office rule following the statute defines a label as "a device or representation borne by an article of manufacture or vendible commodity." Note, then, that the label is borne by the article; that is to say, applied to the article. Now, the same rule defines a print as "a device or representation not borne by an article of manufacture or vendible commodity; but in some fashion pertaining thereto, such, for instance, as a pictorial advertisement thereof." This is the important difference between a label and a print, the former being "borne by an article of manufacture" and the latter "not borne by an article of manufacture."

If a print "bears a device capable of sequestration as a trade mark," it can be registered as a print without respect to the registration of such device as a trade mark. (Ex parte the United States Playing Card Company, 63 O. G., 206.) This is because a print, not being applied to an article of manufacture, is not in any sense a trade mark.

A label being in its application to the article of merchandise more like a trade mark, it was held, prior to ex parte Mahn, 82 O. G., p. 1210, that if such label bore a device capable of registration as a trade mark, "it could not be registered as a label until after the trade mark was registered." The said decision, in ex parte Mahn, has modified the practice of the Patent Office, the Commissioner of Patents saying: "There is no authority of law for the requirement for the registration of the trade mark matter contained in a label as a condition precedent to the registration of the label." This, of course, is based on the assumption that the label is a proper label for registration, that is, "of artistic merit, indicating pictorially or otherwise the article or the contents of the article to which it is to be applied," as, if the label is simply a trade mark, it cannot be registered as a label.

Inasmuch as both prints and labels are registered, if at all, under the copyright law, registration must be effected before the label or print is used or published.

It is evident, therefore, that a print or label to be registered need only, in the case of a label, involve artistic merit and indicate, pictorially or otherwise, the article or the contents of the article to which it is applied; and in the case of a print, involve artistic merit and in some fashion pertain to the article of manufacture or vendible commodity, and that registration be effected before publication or use.

Whether registration as a label will protect use as a print, or vice versa, is not settled; but there is no reason why the same device or representation should not be registered to the same applicant, both as a print and as a label, and the slight expense of registration recommends such course.

Prints and labels, when used, should be marked "copyrighted," with the date—not "registered."

The very slight expense of applying for copyright of labels and prints is worthy of consideration, especially as the government fee is refunded if registration is refused.

In these times, when there is so much activity in advertising wares, when prints are so commonly used on store counters and walls in such advertising, and when the printers' and lithographers' arts render the production of artistic prints and labels so economical, it seems advisable to call the attention of the mercantile public to the present practice as to registration, in order that they may secure the protection for their artistic productions afforded by the statute.

THE VISIT OF COLONEL KRAG.

Colonel Ole Herman Johannes Krag, chief of ordnance of the Norwegian army and inventor of the Krag-Jorgensen rifle, who recently came to this country on a leave of absence, has returned home. Colonel Krag was deeply impressed with the United States, and especially with the intelligence of its citizens. "For this reason," he said, "I believe that the United States can, out of such material, equip soldiers to serve behind rifles much more quickly than any other country." The Krag-Jorgensen rifle is fully described in our "Army and Coast Defence" number. The United States government secured the patent for the manufacture of this rifle in this country by paying Colonel Krag a royalty of one dollar per rifle. About 75,000 rifles are already in the hands of the military authorities in this country, and the government arsenal at Springfield is now turning out the rifles at the rate of 250 a day. In a short time the output will be at the rate of 500 a day, and Congress has been asked to appropriate $800,000 for the expense of manufacturing additional guns. The Norwegian and Danish armies are equipped with this rifle, and France has shown an inclination to adopt it, but hesitates because it is not a French invention.

THE HEAVENS IN AUGUST.

BY GARRETT P. SERVISS.

The long, warm evenings of August, when the atmosphere rests quiet and steady after the fierce heats of midsummer, are a joy to all lovers of the stars. Sitting on lawn or veranda, one can watch, without chill or discomfort, the merging of twilight into darkness, the gradual withdrawal of the rose and azure and gold tinted curtain that conceals the universe and the slow forthcoming of the stars—at first singly and here and there; then in pairs and sets, which forewarn the experienced star-gazer of the emergence of the constellations; and, finally, in groups and swarms and starry clouds, that have been the wonder of all the ages, and are as refreshing to the imagination to-day as they were when the shepherds watched them in Chaldea, or the old Greeks saw them overhead as they tramped across the hills of Arcadia to attend the Olympic games.

Early in the evening, at the beginning of August, the brilliant constellation Scorpio is conspicuous just above the horizon in the south. Its chief star Antares. usually described as red, is one of the most interesting in the heavens. In our latitudes a first-rate 4-inch telescope, under favorable atmospheric conditions, should easily show the minute green companion of Antares. The distance is only about three seconds of arc, and a good magnifying power, say 150 or 200 diameters, should be used. At present the planet Saturn appears as a member of the constellation Scorpio, shining a few degrees north of Antares.

East of Scorpio, where the Milky Way appears very brilliant, is Sagittarius, with the inverted figure of a short-handled dipper visible among its stars. Higher are Ophiuchus and Serpens, with Hercules near the zenith. Hercules is flanked on the west by the Northern Crown and on the east by Lyra, whose great blue-white gem Vega is one of the chief glories of the summer nights. West of the Northern Crown is Bootes with Arcturus, and east of Lyra is Cygnus, with the striking figure of the Northern Cross. South of Lyra and Cygnus the constellation Aquila attracts the eye by its singular combination of a bright star, Altair, accompanied on two sides, at a distance of a few degrees, by a fainter star.

THE PLANETS.

Mercury is an evening star and remains during August in the constellation Leo. On the 9th it is at its greatest eastern elongation and crosses the meridian about an hour and three-quarters after the sun.

Venus is the cynosure of the sunset sky, far more brilliant than Jupiter, although less than half as bright as it will be in October. The fact has recently been pointed out that, for observations of Venus, telescopes of comparatively small aperture are very effective. Daylight observations are best, and amateurs can make them without great inconvenience. It is only necessary to know nearly the place of Venus in the sky at the time of observation in order to find the planet in full daylight. During August, Venus will cross the meridian not far from a quarter before three o'clock, or, in other words, two hours and three-quarters after the sun. But it is considerably south of the sun—a fact that must be properly taken into account in searching for the planet on the meridian. On August 10 Venus will be only five minutes of arc north of the celestial equator when crossing the meridian of Washington. It will be easy to find her then, anywhere in the eastern United States, by pointing the telescope, a little before a quarter to three o'clock, toward true south, at an elevation corresponding to the difference between the latitude of the place of observation and 90°. Suppose, for instance, that the lattitude is 40°, then the elevation of the telescope should be 50°. If the planet is not found directly in the field of view, a little careful sweeping will be certain to pick it up. A cap with a circular hole about half the aperture of the telescope should be placed over the object glass, unless the telescope is less than three inches in diameter. Any markings seen with certainty on the disk of Venus should be carefully recorded.

Mars is gradually coming more clearly in evidence as a morning star, although still distant and inconspicuous. It is in Taurus at the opening of the month, about 5° north of Aldebaran, and at the close it will be found just over the border in Gemini.

Jupiter, in Virgo, moves slowly eastward, passing south of the celebrated double star Gamma, in the course of the month. On the 14th Jupiter crosses the meridian at 3 o'clock in the afternoon. Jupiter and Venus approach one another, until, on the evening of the 18th, they will be only about 2° apart.

Saturn remains in Ophiuchus, just above Antares in Scorpio, crossing the meridian early in the evening. Its chief satellite, Titan, is at western elongation at midnight on the 2d and at eastern elongation in the evening of the 10th, returning to western elongation an hour before midnight on the 18th.

Uranus is in Libra, on the border of Scorpio, a few degrees west of the double star Beta Scorpionis.

Neptune remains near Zeta Tauri.

THE MOON.

There are two full moons in August, on the 1st and the 31st. The new moon occurs on the 17th, the first quarter on the 24th, and the last quarter on the 9th.

The moon is nearest the earth on the 28th and farthest from it on the 12th.

The lunar conjunctions with the planets occur as follows: Mars, 11th; Neptune, 12th; Mercury, 19th; Jupiter, 20th; Venus, 21st; Uranus, 24th; Saturn, 25th.

METEORS.

The celebrated August meteors appear on the night of the 10th, radiating from the constellation Perseus, which rises in the northeast.

A NEW CENTER OF THE PLAGUE.

Prof. Koch has announced the results of his investigations on the plague. He declared that the view entertained some ten years ago that the plague no longer threatened mankind must be abandoned, for there are now no less than four plague centers, the last of which Prof. Koch discovered in the Hinterland of German West Africa. Former outbreaks have been traced to Mesopotamia, where it has never entirely disappeared; but in China the plague is endemic, the plague center being in the Province of Hunan. There is a second plague center in Thibet; the latest outbreaks in China and India have had their origin there. The third center is in the neighborhood of Mecca, on the west coast of Arabia, and this center is of the greatest possible importance in view of the great number of pilgrims which annually visit the sacred city of Mohammed. Nothing was known of any other plague center until Prof. Koch discovered the fourth was in equatorial Africa. It was found that a devastating disease prevailed at Kissiba. Prof. Koch suspected it was the plague and proceeded from India to West Africa, and was able to diagnose the disease as the bubonic plague. Nine out of ten of those infected died. The disease was communicated to rats and monkeys, and it was found that an outbreak of the plague among rats frequently precedes an epidemic among human beings, and the rat plague may always be regarded as a salutary warning. The old explanation that it was found wherever dirt and social misery prevailed is inadequate. No satisfactory answer has yet been given as to the real origin of the disease.

DESTRUCTION OF A WAR BALLOON.

The war balloon used in reconnoitering the position at Santiago was destroyed. The balloon was held by eighteen men by a rope which was 1,000 feet long. The men moved about in various parts of the field, carrying the captive balloon with them. A telegraph wire connected the basket of the balloon with the ground, and observations were transmitted to the officers below. The balloon was received by a scathing fire. Three shells from a shrapnel battery tore great holes in it, and the showers of bullets made it resemble a great sieve. The three men who were in the basket at the time the balloon was destroyed escaped with but one slight injury. The balloon was finally landed in the middle of a stream waist deep, just as two regiments of dismounted cavalry were charging a Spanish ambush. The balloon has been an effective adjunct in reconnoitering in the Santiago campaign. It will be remembered that in the siege of Paris the invested Frenchmen sent up many balloons to carry deputies, dispatches, and mail, and Herr Krupp made special cannon to fire upon them. It consisted of a long barrel mounted on a standard so that it could be readily turned in any direction. The standard was secured to a four-wheeled platform wagon.

EFFECT OF X RAYS ON COLORS.

Sir William Crookes has shown that various gems and minerals glow with a beautiful tinted phosphorescence in the cathode rays of his vacuum tubes, and M. Leconteur and Mr. A. C. Cossor applied this fact to the examination of precious stones and minerals of uncertain constitution. A large number of gems of various kinds, shown under the rays, were quite altered in color by the phosphorescence. Four large Burmese rubies, for example, weighing twenty-two and a half carats, glowed a fiery red. Singalese rubies were easily told from Siamese by the phosphorescence. Diamonds became a light blue or green; moonstone gleamed like moonlight just after the rays were withdrawn from it; American dolomite was red; tungstate of calcium, a turquoise blue; sea shells, a rich golden yellow and light blue, and so on. Questionable stones can thus be tested without injury to the gem. Moreover, the method is applicable to toxicology in the case of alkaloids, and will be useful in medical jurisprudence.

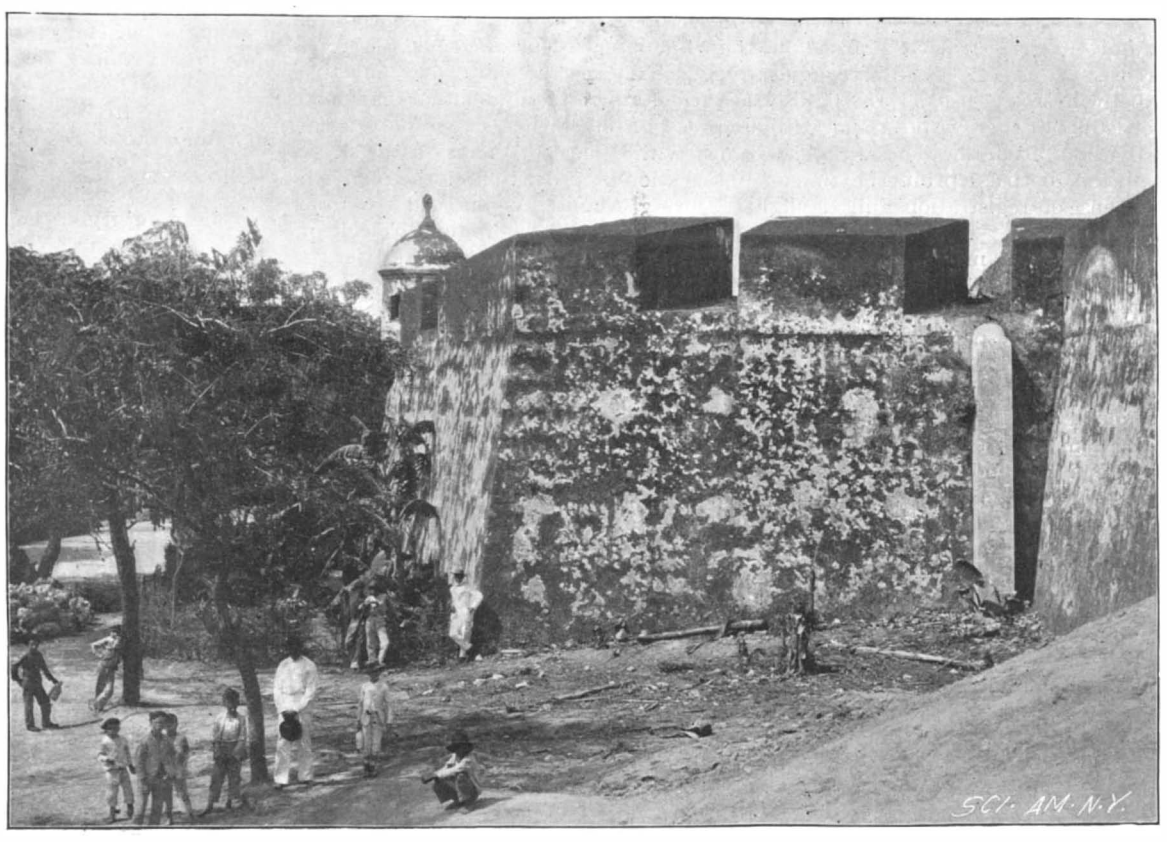
© 1898 SCIENTIFIC AMERICAN, INC.

SAN JUAN AND ITS DEFENSES.

Every few weeks the theater of action of the war changes, and now once more Porto Rico is the objective point of an expedition sent to conquer it. This island is the most productive of all the possessions which Spain has had in the nineteenth century. San Juan, which our fleet bombarded on May 12, is strongly fortified, but at that time Rear Admiral Sampson had no intention of capturing the town. He wished only to draw the fire of the batteries so as to locate them and destroy as many as possible. He was successful in his attempt, and he did not intend to try to land any soldiers or marines. Now, however, a large army will invest the city and will co operate with the fleet in its bombardment.

STREET SCENE, SAN JUAN, PORTO RICO.

San Juan, the capital of the island of Porto Rico, lies on the northeast shore of the island and has a population of about 28,000. The harbor is one of the finest in the West Indies, being large, sheltered, and capable of accommodating any number of the largest ships, having an anchorage of from three to seven fathoms. It bears a very striking likeness to Havana Harbor, to which it is but little inferior. Its entrance toward the north is invitingly open to the vessels of our great republic, being over 2,000 feet wide, and the harbor is defended on the west side by forts erected on two small islands. The city occupies what is generally supposed to be an island, but the city is really built on a coral reef. It is a long, irregular peninsula, and it is connected with the mainland by a short bridge at the eastern end. The town is completely inclosed with massive walls of stone and mortar which rise to a height, in some places, of from 50 to 100 feet. It is a perfect specimen of a walled town with portcullis, moat, gates, and battlements. The fortifications were begun over 250 years ago, and were still in good condition until they were attacked by Admiral Sampson. Like Havana and Santiago, San Juan has a "Morro" Castle, or citadel (really a round Moorish tower). The walls have many sentry boxes at intervals hanging out over the sea on the grim, gray walls. One can find a counterpart on a small scale in the old fort at St. Augustine, Florida, and they are in every way similar to those at Havana before her walls were torn down. The peninsula on which Morro and the lighthouse stand is thrust out into the sea, one side breasting the thundering surges of the Atlantic Ocean and the other guarding the placid waters of the beautiful and almost landlocked harbor. The fortifications have one advantage over a fleet in being at a considerable elevation, thus enabling them to deliver a plunging fire. In Admiral Sampson's attack on San Juan only one man was killed on the American vessels, and the Admiral's ships did great damage, destroying many of the batteries.



THE OLD WALL, SAN JUAN, PORTO RICO.

Inside the walls the city is laid off in regular squares, six parallel streets running in the direction of the length of the peninsula and seven at right angles. The houses are closely and compactly built of stone and are usually one or two stories high, stuccoed on the outside and painted in a variety of colors. The upper floors are occupied by the more respectable people, while the ground floors are almost without exception given up to negroes and the poorer classes. The population within the walls is estimated at 20,000, and most of the people live on the ground floors. In one small room, with a flimsy partition, a whole family will reside. As may be supposed, these ground floors of the whole town reek with fever, and the conditions are most unsanitary. As Porto Rico is a tropical country, where disease would readily get a foothold, the consequences of such herding may be easily imagined. There is some water supply, but the population depends also on rain water caught on the flat roofs of the buildings and conducted to the cistern which occupies the greater part of the courtyard which is an essential part of the Spanish house the world over. There is no sewage except for surface water and sinks, and the risk of contaminating the water in the cisterns by adjacent vaults is very great. Epidemics are frequent, and the town is alive with vermin, mosquitoes, and dogs.

The streets are wider than in the older part of Havana, and will accommodate two carriages abreast. The sidewalks are very narrow, and will only accommodate one person. The pavements are of a composition manufactured in England. They are unfit for very heavy traffic, but are pleasant and durable when no heavy strain is brought upon them. The streets are swept once a day, by hand, and, strange to say, are very clean. From its topographical situation, the town should be healthy, but it is not. The soil under the city is clay, mixed with lime, and it is so hard as to be almost like rock. It is, consequently, impervious to water, and furnishes a good natural drainage. The trade winds blow strong and fresh, and through the harbor runs a stream of sea water at a speed of not less than three miles an hour. With these conditions, no contagious disease, if properly taken care of, could exist, and without them the place would be a veritable plague spot.

Though the main portion of San Juan is inclosed within the walls, through which entrance is obtained only by well guarded gateways, yet there is a small town by itself between the Marina and the walls which contains two or three thousand inhabitants. Here is to be found a public garden and pleasure space for booths and restaurants, as well as a public cockpit where battles royal are frequently waged. There are also two suburbs, San Turce and Catano, across the bay, reached by a ferry.

The present expedition to San Juan will not be the only one which has been sent to capture the capital. In 1596 it was sacked by Drake and in 1598 by the Duke of Cumberland. In 1615 a Dutchman, Baldwin Heinrich, lost his life in an attack on Morro Castle. The attack of the English in 1678 was equally unsuccessful, and Abercrombie in 1797 had to retire after a siege of three days.

To Beautify Railway Stations.

Resolutions were adopted at the last meeting of the Society for the Preservation of Historic Places and Objects, and these resolutions were sent to the presidents of fourteen of the leading railways which lie wholly, or in part, in the State of New York. The resolutions go on to say that most of the railroad stations in the State of New York are devoid of scenic attraction and landscape embellishment, and in this respect they are certainly inferior to those in other States, notably Pennsylvania. They make an excellent point of saying that the avenues of steam traffic through the cities and villages of the State are almost always bordered by unattractive conditions which, unless they are counteracted by more pleasing surroundings at the stopping places of trains, create an unfavorable impression of the community in the mind of the traveler. Experience has demonstrated that great improvements can be made in the way of lawn adornment by the systematic arrangement of trees and shrubs and the better disposition of paths and drives, and this can be effected at a comparatively small cost. Municipal authorities are asked to co-operate with the railroad companies in a park-like treatment at the centers of the passenger traffic.

Speeds per Second.

The snail, one-half inch; a man walking, 4 feet; a fast runner, 23 feet; a fly, 24 feet; a fast skater, 38 feet; a carrier pigeon, 87 feet; locomotive — sixty miles an hour — 88 feet; swallows, 220 feet; the worst cyclone known, 380 feet; the Krakatoa wave —at the volcanic catastrophe of August 27, 1883, in the Sunda Islands — 940 feet; the surface of the globe on sea level at the equator, 1,500 feet; the moon, 3,250 feet; the sun, 5½ miles; the earth, 18 miles; Halley's comet in the perihelion, 235 miles; electric current on telegraph wires, 7,000 miles; induction current, 11,040 miles; electric current in copper wire armatures, 21,000 miles; light, 180,000 miles; discharge of a Leyden jar through copper wire one-sixteenth of an inch in diameter, 277,100 miles, which is said to have been the highest velocity measured.—The Wave.

THERE are more blind people among the Spaniards than any other European race.

© 1898 SCIENTIFIC AMERICAN, INC.

The Megaphone in War.

The "megaphone," the modern speaking trumpet, has played an important part in the present war. The navy have been using the megaphone only about a year, and already it has been regarded as a necessary adjunct on every ship. The standard size is about 2½ feet long, and the large end is about 15 inches in diameter. It has a light handle and an aluminum mouthpiece. The smaller craft only carry one, but the larger vessels have a number. Thus, the flagship "New York" has one on the bridge, one on the signal bridge, and one on the quarter deck. In the old days, the officer of the deck used the speaking trumpet, and they were often as elaborate as those owned by volunteer firemen. On sailing vessels, in a storm, the voice will not carry from the quarter deck to the foremast head, nor can it be heard to windward of a large sail, so that a speaking trumpet is always kept at hand. They were small and convenient, but are inferior to the modern megaphone. Every inflection of the voice is magnified by the megaphone to wonderful degree, and the sounds may be heard at a great distance. The orders to the vessels of the fleet doing blockade duty off the Cuban coast have been issued through megaphones. Torpedo boats and the converted yachts and tugs assigned to special duties receive a large proportion of their orders from the flagship by megaphone, and turned in their first brief reports in the same way.

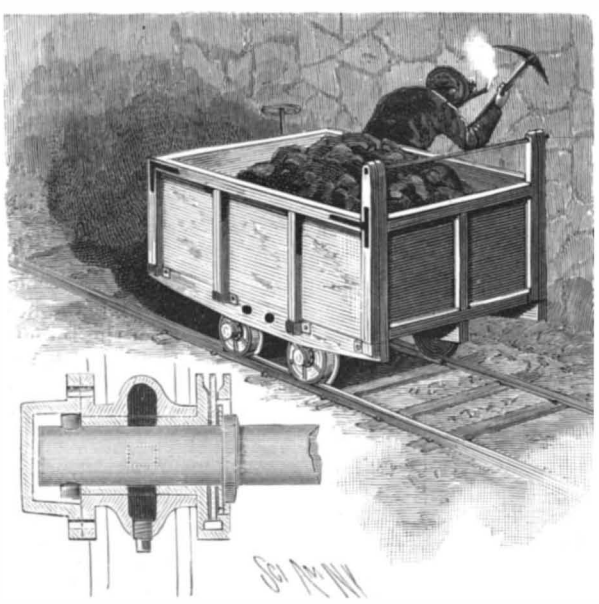
The Industrial Commission.

Under the provisions of the law creating an industrial commission Vice-President Hobart has appointed Senators Kyle, Penrose, Mantle, Daniel, and Mallory. Speaker Reed has appointed five representatives, Gardner, Lorimer, Lovering, Livingstone, and Bell. Nine members who shall fairly represent the various industries of the United States are yet to be appointed by the President. The idea of the commission is to investigate questions relating to immigration, to labor, to agriculture, to manufacture, and business. It will report to Congress and suggest such legislation as the commission may deem best upon these subjects and an attempt will be made to secure uniform legislation by the various States in the Union, in order to harmonize conflicting interests and which will be equitable to the laborer, producer, employer, and consumer. Hearings will be given and the commission has the power to send for witnesses and papers and administer oaths.

AN IMPROVED OIL-RETAINING BOX.

To provide an oil-retaining box arranged to keep the lubricant in good condition and always in position on the journal or bearing until it has been completely used up, Samuel Salmon, of Drifton, Pa., has invented and patented an arrangement by means of which the desired end in question is attained.

The device is applied to a mining car-wheel, the axle having its journal-bearing revolving in a box in the form of a bushing which is fitted in the hub of the wheel. On the inner end of the hub the enlarged end of the bushing fits and forms the guideway for a closing shield applied to the journal next to the shoulder on the axle. Openings are made in the bushing at the middle portion which register with an annular oil-chamber formed in the hub. The lubricant is thus enabled to pass from the chamber to the journal. On the outer end of the journal a linch-pin is secured, as shown in the sectional view, and lies against the end of the bushing so as to hold the bearing or journal in proper position. The collar or shoulder on the inner end of the axle, it is to be observed, lies against the outer face of the enlarged end of the bushing.



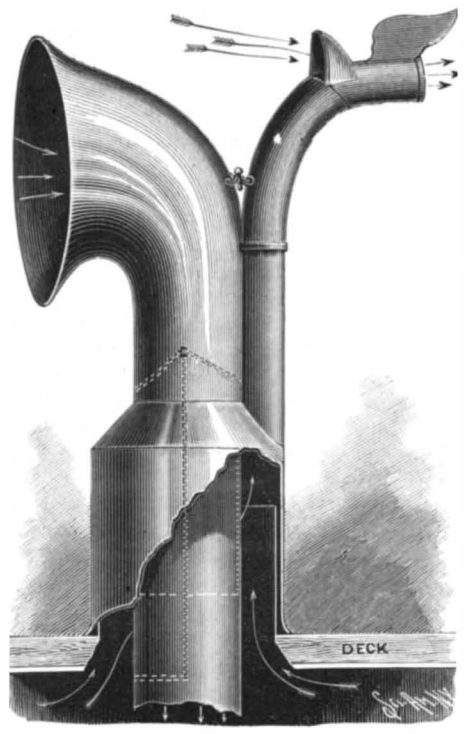
SALMON'S OIL-RETAINING BOX.

Since the closing shield lies snugly on the axle, the lubricant is prevented from leaking past the inner end of the journal and, it is claimed, is therefore enabled to be used without waste.

A NOVEL HOUSE-COOLER AND VENTILATOR.

A patent has recently been granted to James B. Slade, of Riverhead, N. Y., for a device by means of which buildings, ships, mines, and boiler rooms are constantly supplied with fresh air, a free-exit being provided for the foul and vitiated air.

The contrivance consists of a tubular casing adapted for insertion in a circular opening in the roof of a building or the deck of a vessel. Inside of the casing a sleeve is so supported as to leave an air-passage between the casing and the sleeve. Mounted in the



SLADE'S HOUSE-COOLER AND VENTILATOR.

sleeve is a tube provided internally with a spider or frame, and at its upper end with a rotatable ingress-tube. This ingress-tube likewise has a spider or frame on which a rod is centrally pivoted. The upper end of the casing is inclosed by a hood formed with a conical end, through which the ingress-tube passes. With the conical end of the hood an egress-tube is connected which communicates with the interior of the hood. These ingress and egress-tubes are curved in opposite directions, and are mounted to swing in such a manner that the ingress-tube shall constantly present its opening to the wind.

The ingress-tube continually forces a column of air downward through the building, and the egress-tube permits all warm or vitiated air to escape. Any vacuum formed by ventilation, it is said, will be immediately filled by the air pressed into the cold tube entering a room at the bottom. The ventilator at the rear or leeward of the hood constitutes an air-passage, creating a vacuum below and drawing up the warm air.

A Railroad in the Philippines.

The Manila and Dagupan Railway, the only railway in the Philippine Islands, is running along smoothly as if peace prevailed throughout the land, says the Manila correspondent of The Railway Age. Ordinarily railroads suffer as much inconvenience and loss in business and damage as any other line of business at times when comparatively small countries are in a state of rebellion. This loss is not only because of demoralization in freight business and from common disinclination of people to travel where the existence of social disorder creates an additional element of risk in traveling on public carriers, but because of destruction of railroad property, as a matter of proper warfare and military strategy, as has been the case in Cuba. The Philippine railroad has been remarkably fortunate in the respect of enjoying immunity from inconvenience and violence at the hands of the insurgents—so fortunate, indeed, as to agreeably surprise and disappoint the management of that property.

The road is of 3 foot 6 inch gage, and runs from Manila, with a population of over 200,000, in an almost northerly direction, 125 miles, through several large municipalities to Dagupan, a reasonably prosperous seaport of about 30,000 souls. The island of Luzon, of which Manila is the capital, has a population of about 3,500,000, nearly half the entire population of the twenty-one islands that form the Philippine group, and with an area of nearly double that of Great Britain. The railroad, as might be expected, runs through the most populous section of Luzon.

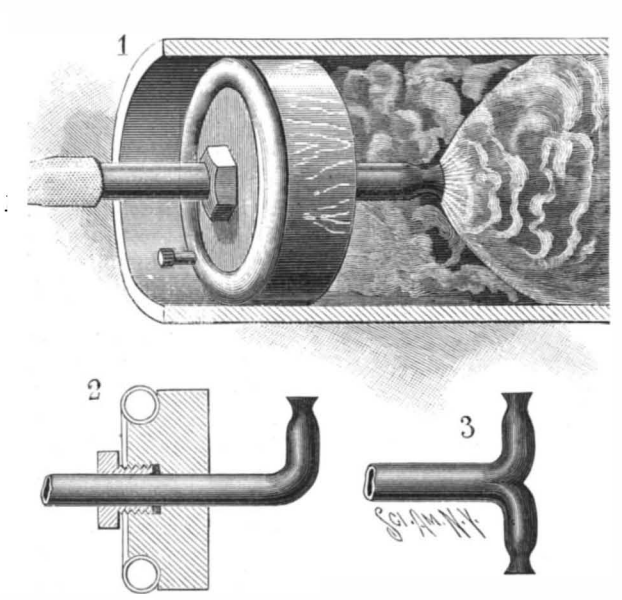
While the railroad is private property and owned and managed by Europeans other than Spaniards, it was thought the insurgents would nevertheless try and prevent its operation, at least spasmodically, inasmuch as it was proving of so great advantage to the government in the effort to quell the revolt. There has, however, been no trouble with the road as yet. The forbearance of the rebels has caused no little surprise among Spanish officials. The insurgents derailed a passenger train several months ago. Since that time there has been absolutely no violence. The rebel leaders were very much displeased when they learned that some of their subordinates had molested a train, and at once gave orders that the personal and property rights of foreigners other than Spaniards should be respected and that this order was intended to apply particularly to the railroad, which they well understood was the property of English capitalists. The fact that the railroad company has not since been subjected to the slightest trouble or inconvenience, while the immediate country is involved in very serious and formidable revolution, demonstrates these facts: 1. That the Filippinos are not savages, warring just for the excitement of the thing. 2. That they are a peaceful and easily governed people, and are regarding with respect the wishes of their recognized leaders. 3. That they value the good will and sympathy of Europeans who live in the Philippines and will unquestionably see to it that these foreigners are protected to the fullest possible extent.

Gold Extraction with Potassium Permanganate.

A new process for the extraction of gold has been tried with success in the gold districts of New Zealand. The finely powdered auriferous ore is first mixed with common salt and sulphuric acid, and potassium permanganate is then added in solution. Hydrochloric acid is formed by the action of the sulphuric acid on the salt, and from this chlorine is liberated by the permanganate. The chlorine then combines in the nascent state with the gold, forming soluble gold chloride. The new method is said to have many advantages over the cyanide and amalgamation processes. The chemicals used are harmless, non-poisonous, and cheap, and the extraction of gold from the ore is nearly complete. A particular advantage lies in the fact that the process can be applied to ores containing copper for which the cyanide process cannot be used. A gold mine at Mount Morgan, New Queensland, obtained by the permanganate process 95 per cent of the gold present from ore yielding only 20 per cent by the cyanide process. The ore contained also copper, iron, antimony, and manganese.—Sūdd. Ap. Ztg.

A NEW FLUE-CLEANER.

In an invention patented by Charles H. Carrico, of Salt Lake City, Utah, novel means are provided for blowing out chimneys, smokestacks and other flues, the device employed being of that type in which a steam-pipe is passed into the flue and held by a stopper which closes the flue and prevents the reaction of the steam while cleaning out the soot or other foreign matter. Of the accompanying illustrations, Fig. 1 shows the flue-cleaner in operation; Figs. 2 and 3 are modifications of the steam-pipe used. The stopper is circular in form, is made preferably of wood, and is adapted to fit in one end of a flue, as shown in Fig. 1. Through the central portion of the stopper an opening is made into which the steam-pipe is inserted. A rubber gasket encircles the pipe and bears against a shoulder formed on the body-portion of the stopper. A hollow screw-plug embraces the pipe and presses against the gasket to hold the steam-pipe in place and to effect an hermetic connection between the pipe and the stopper. On the periphery of the stopper near the inner end, a groove is formed, into which is fitted an elastic expansible tube. When by means of a valve this tube is inflated, the opening of the flue is hermetically sealed. When the jet of steam is exerting its utmost force in blowing out the flue, the stopper will still be held in position by the elastic expansible tube. The modifications shown in Figs. 2 and 3 are designed to produce a lateral jet of steam in flues when other forms of nozzles would not be serviceable.



CARRICO'S FLUE-CLEANER.

© 1898 SCIENTIFIC AMERICAN, INC.

The Care of Troops in the Tropics.

Allusion has heretofore been made in these columns to the adverse criticisms passed upon the War Department in reference to its care of our troops. Doubtless there are, or were, shortcomings, to be credited largely to hurried mobilization and the necessity for creating resources that before were non-existent; but such are sure, in great measure at least, to regulate themselves in consonance with the knowledge derived from experience. Experience, however, is often a costly means of acquiring knowledge; and now the invasion of Cuba is fait accompli, coupled with the fact that its climatic conditions and surroundings are quite different from anything hitherto experienced by either our regulars or volunteers, some of the late lessons taught our Anglo-Saxon brethren across the water in their occupation of tropical regions may acquire new values and afford new opportunities for application.

Formerly, the west coast of Africa excepted, the West Indian stations of the British army were regarded as the most malignant and deadly within the limits of the empire. To-day all occupied by white troops are remarkable for their cleanly, healthy, and salubrious character. Much the same may be said of the stations in the Orient, those of Central India more particularly, which region has a certain similitude to Cuba as regards topography; both lie between the 20th parallel of latitude and the Tropic of Cancer, and both alike present successive areas of low and alluvial soil, tableland, and hill country.

It has been declared that most of the ills of the soldier are of his own making; but, however true this may be, it in no way excuses military executives for shortcomings, and, notoriously, these very shortcomings in many instances have slain more men than either miasm or bullets.

The routine assignment of the regiments in the British service constitutes no small factor in acclimatization. Except in dire emergency, this is progressive: The regiments that embark at Southampton proceed to Gibraltar, Malta, and Cyprus, and from thence after a time are distributed to the Far East. The return is a reversal of the outgoing, the regiments being, however, differently distributed; and next they, or a portion thereof, are forwarded to Jamaica, Barbadoes, Trinidad, and St. Lucia; a few, perhaps, reach Halifax before returning to England. Black troops—the West India regiments—are exclusively employed as garrisons at Demerara, Honduras, and on the African West Coast, and not infrequently in Bermuda, and occasionally at St. Lucia.

During the latter part of the last century and the early years of the present one, the death rate among the white troops in the two Indies was appalling. During a service of five years, certain regiments 1,000 strong lost all their original members; and one regiment, 860 strong, stationed at Apostle's Point—sometimes termed "Angel's" Point—at the entrance to Port Royal, Jamaica, lost more than one-third its strength in less than twelve months. The average mortality in Central India from 1838 to 1856 was 79·20 per thousand, and in the West Indies nearly or quite as great, though accurate statistics are not obtainable. In 1860 the mortality in India had fallen to 31·27, and in 1888 was but 15·73; in the West Indies for 1878 it was 16·18, which fell to 3·44 in 1888. From the latter figures, it would appear the Antilles are more healthy to Europeans than India, and this is true; but it must also be remembered the stations in the former are few, and being no longer of strategetical importance, are located in the most salubrious situations. The conditions in the East are widely different: Regiments are obliged to do tours of duty in low-lying miasmatic districts, as well as in the more salubrious tablelands and hills, such being due to "exigencies of the service;" further, in India the population is so dense as to induce unsanitary surroundings that, by reason of an universal fatalistic belief and religious prejudices, are difficult if not impossible of eradication.

Long continued high temperatures; alternations of great atmospheric dryness and moisture; rapidly moving, perhaps dry and hot, air—all are common conditions in the tropics; and when to these is added the development of malaria, it is evident those accustomed to a temperate climate cannot support such surroundings without material detriment to health, except most extraordinary measures for protection are taken. For these reasons, if no other, the sanitary and hygienic conditions governing the soldier require careful but firm enforcement.

The tablelands and hills, being less malarious, and affording a more pure supply of air, should in so far as possible be selected for camps; further, in these situations liver maladies are uncommon, and intestinal fluxes neither so frequent nor violent. British military authorities lay great stress on the foregoing, and camps and barracks are located, in as far as opportunities permit, in consonance therewith.

Formerly the barracks employed for troops in the tropics were exact prototypes of the quadrangular structures that obtained in England—crowded, ill ventilated, stuffy, and hot; notoriously, at one time, the convict barracks at Bermuda were far superior to the quarters provided for the troops. To-day, the tropical barracks are large, commodious, two-storied buildings, elevated on arches of masonry several feet above the ground, and the walls exposed to the sun shadowed by wide verandas; there is also a double roof, with several feet of intervening space and permitting free circulation of air. Only one-half company is allowed in any one building, and only 16 to 20 men may occupy the same room, and to each is secured not less than 90 feet of superficial space and 1,800 feet of cubic space; besides thorough cross ventilation is provided for. Again, in tropical barracks no room is less than 24 feet wide and 20 feet between floors and ceilings. In some portions of India the barracks fairly deserve the titles of "palaces"—notably those at Allahabad—bestowed upon them by the natives, and they also afford ample evidence of the desire of the authorities to properly care for and conserve the health of "the nation's defenders."

When ordered for tropical service, the English soldier is given an entire new outfit of clothing. Drill trousers and cotton jackets are the rule, perhaps also an extra tunic of scarlet serge. In India complete suits of khaki (a native gray or dust-colored cloth) are commonly worn, the regulation uniform being donned only when the conditions of climate and temperature demand. Many of the officers wear tunics of grass-cloth. The use of the kammerband, or wide flannel bandage, over the abdomen (preferably next to the skin) is general, and in fact often enforced, as constituting a wise precaution against the intestinal fluxes that are so prevalent and against a chilling that predisposes to malarial attacks. For central African service a brown drill uniform, similar to that adopted by the United States for the campaign in Cuba, is served out—a uniform that originated with the Cape Mounted Rifles; but the felt hat and leggins were speedily abandoned as unsuitable and cumbersome, and replaced by ankle boots and a bamboo wicker or a "Tuson" helmet. The bamboo helmet, which is light, comfortable, durable, and every way effective, is covered with cloth and provided with a puggery; the "Tuson" consists of two bodies, one within the other, forming a complete air chamber, not only in the crown, but in the brim as well. Manifestly, the head covering of the soldier in the tropics should present the least possible surface to the wind, should not embody a single half-ounce of superfluous weight (hence should not be permeable to water), offer the greatest facilities for coolness, and yet not be cumbersome—conditions that cannot be filled by a structure of felt. Leggins, if of leather, and not of good quality, lose their suppleness and press on the ankles and instep; so also do those of cloth, in less degree, when they have been wet a few times and become saturated with dust—they only possess the advantage that at the end of a march they can be at once removed and cleaned, a bit of care that cannot often be inculcated or enforced.

Ankle boots with good serviceable tongues, and made to either lace or buckle, are now exclusively used by the British army, and have even been adopted by officers; they can be made to fasten the bottoms of the trousers—purposely made short—to the ankles in a way to exclude dust. English regulation boots are made on the principles laid down by Camper, Meyer, and others, and they are had in thirty-two sizes—eight in length and four in breadth—with very low, broad heels. The inner line is straight, so as not to push outward the great toe in any degree, and there is a bulging over the root of the same toe to allow for easy play of the joint; across the tread and toes it is very broad, so that lateral expansion may not be impeded. Great care is taken in the inspection of boots, which are of the very best quality and made in a specified way. The size is proved by standard measure, the excellence of the leather and quality of the sewing by selecting at random a certain number of each lot and cutting them up, when the slightest defect in one entails rejection of all. It is required there be not less than eight stitches to the inch, and even the number of strands, their thickness, and the waxing are carefully set forth in the specifications. Practically the same inspection governs the acceptance of clothing, which is always of the very best quality and altered by the company or regimental tailors to accurately fit the individual, as much care being taken in this regard as if preparing a suit for a Regent Street dandy. It is the attention to even the more minute details of uniform that has given Tommy Atkins his reputation for smartness and neatness.

The daily ration of the British soldier in the tropics consists primarily of 24 ounces of fresh meat, 16 ounces each of bread and potatoes, 4 ounces of rice, 2·5 sugar, 0·71 tea, and 0·66 salt, besides pepper, vinegar, beer, etc. If salt meat is served, the amount is one-third less, but salt meats are abjured as much as possible, since scurvy is more prevalent in the tropics than elsewhere and, moreover, more fatal. Fresh vegetables are largely substituted for part of the potatoes and all the rice ration; lime juice is frequently served; and a convenient canteen at which all articles are sold at absolute cost price is always available, and even arranged for on a march. Experience has proved that the use of alcoholic beverages is to be condemned in the hot climates and that even wines must be employed with moderation; but light wines, such as clarets, in reasonable quantity, diluted with water, are beneficial rather than otherwise; but as the private soldier cannot indulge in wine, he is provided with a light beer, but never in amounts exceeding one quart daily. The native liquors of both the East and West Indies are all vile, often drugged, and usually mixed with cayenne or other hot or pungent substances. The cheap rum (caña—"nigger rum") of the Antilles, derived from sugar and cane waste, is especially pernicious.

The United States Army Numbers 227,000 Men.

A statement prepared in the office of the Adjutant-General shows that the total strength of the army, regular and volunteer, to July 19, is 227,000—44,000 regulars and 183,000 volunteers. Under the second call for volunteers there are 15,000 vacancies, while the regular army is about 18,000 men short of the number authorized by law. Under the second call the various States and Territories were to furnish 37,566 men to fill vacancies in existing regiments, so as to raise them to their maximum strength. For this purpose 27,519 men have been enlisted, leaving the several volunteer regiments 10,000 short.

The statement shows that twenty-five out of the thirty-three States called on to furnish additional volunteers have failed to recruit the required number up to this time. In some cases, however, notably those of Illinois, Iowa, Maryland, Ohio, and Pennsylvania, the recruiting is nearly to the limit prescribed. The Southern States have not responded in as gratifying a manner as was hoped. North Carolina has shown practically no interest in responding to the second call, as only 55 enlistments, or 7 per cent, have been made to fill the quota of 783 required. Other States that are far behind in response to the second call are Alabama, with not quite 40 per cent of enlistments; Colorado, 32 per cent; Georgia, 36 per cent; Louisiana, 23 per cent; Maine, 45 per cent; Massachusetts, 36 per cent; Mississippi, 33 per cent; Nebraska, 27 per cent; Tennessee, 33 per cent; Virginia, 32 per cent. These States have exceeded their quotas: Indiana, Minnesota, New Jersey, Missouri, New York, West Virginia, and Wisconsin.

The following table shows the quota of each State under the second call and the number of enlistments:

State.	Number Required.	Number Enlisted.
Alabama	675	258
Arkansas	600	379
Colorado	300	96
California	1,016	624
Connecticut	495	331
Georgia	704	255
Illinois	2,380	2,331
Indiana	1,304	1,334
Iowa	1,968	1,549
Kansas	900	613
Kentucky	938	602
Louisiana	600	142
Maine	354	159
Maryland	580	533
Massachusetts	1,536	541
Michigan	1,200	878
Minnesota	900	961
Mississippi	600	202
Missouri	1,552	1,567
Nebraska	600	167
New Hampshire	300	206
New Jersey	900	928
New York	3,704	2,738
North Carolina	783	55
Ohio	3,846	3,162
Oregon	300	163
Pennsylvania	4,163	4,083
Rhode Island	300	220
Texas	1,128	505
Tennessee	900	300
Virginia	900	294
West Virginia	300	315
Wisconsin	900	924

Naval Smokeless Powder Factory.

Plans have been perfected by Captain Charles O'Neil, Chief of the Bureau of Ordnance of the Navy Department, for the erection of a factory which will be in operation within a year and which will be capable of turning out at least one thousand pounds of smokeless powder per day. The superintendent of the Indian Head proving ground is clearing up a plot of the land, several thousands of acres in extent, which is on the government reservation at Indian Head and which borders on an estuary of the Potomac River, which is deep enough for vessels of fourteen feet draught. The powder made at the Dupont Powder Works and the California Powder Works is satisfactory, but Captain O'Neil believes it would be wise for the government to have a plant of its own, which would be independent of strikes and shut-downs, which are liable to occur in factories which are run for commercial purposes. The establishment of a smokeless powder factory was authorized by Congress in the last naval appropriation bill, which guaranteed $93,927 for the construction of the buildings and the purchase of machinery. The government will buy the materials for the twenty buildings required and the structure will be put up by government employes. The plans are being prepared in the Ordnance Bureau and at the Washington navy yard. The powder factory will be connected with the proving ground by trolley railway and it will be supplied with everything which will tend to make it safe and convenient.

© 1898 SCIENTIFIC AMERICAN, INC.

Coatings for Submarine Parts of Vessels.

According to Hummel, the necessity of special paints to cover the parts of vessels below the water dates back to the introduction of iron and steel into shipbuilding. Wooden ships were protected from becoming covered with seaweeds and crustaceous animals by a copper or copper and zinc sheathing. The same remedy has been tried for iron vessels; but the copper sheathing is only employed if the ships cannot be docked and subjected to a cleansing of the submarine portions for years. As regards painting the vessels with red lead or iron minium, white lead or zinc white, these mediums are absolutely ineffective to prevent growth of organisms, nor do they prevent the rusting of the iron. Priming the steel vessels with lead minium has also been given up, since one has become convinced that lead preparations are converted into lead chloride under the influence of sea water, which is said to form iron chloride and lead in contact with iron. The lead metal precipitate calls forth a strong galvanic current and causes further corrosion.

Hummel enumerates the following fundamental conditions for the usefulness of the coatings: (1) The compositions should protect the ship's hull from corrosion; (2) should form a smooth surface so as to decrease the friction; and (3) should dry quickly, so that the cleansing of the submarine parts and a double coating can be accomplished in one day. In the case of new steel vessels, the armor plate is usually covered with a skin which must be removed by immersing in diluted hydrochloric acid; otherwise this layer will drop off and take the paint above it along, the bared spots being subject to quick rusting. New vessels should be repainted at least every six months, until there is absolute certainty that the paint has a firm foundation. The composition of the paints varies. MacInnes used for priming a lake containing iron oxide, over which was applied a warmed mixture of copper, etc. Gisbourne mixed quicksilver with chalk, thus preparing a thick, slow-drying oil paint which was used over a lead minium coat. As an important progress in the protection of vessels must be regarded a solution of shellac in spirit introduced by Heinrich Rahtjen. This solution was mixed with iron oxide, adding some linseed oil for elasticity. The first coat of paint served for insulation, and was supplemented by a second one from the same materials, with the addition of arsenic and quicksilver. Such paints excel in permanency, because the salt contained in sea water has little action on shellac; from the quicksilver contained in the second coating mercuric chloride is slowly formed by the action of the sea water, which has a destructive influence on the organisms. Rahtjen's paints dry quickly, so that two or three coats can be put on in one day. It is impossible, however, to introduce large quantities of mercury into the paint, as the shellac solution itself would be destroyed thereby. Besides, the solubility of shellac is very slight, so that the effectiveness of the paint decreases as the time passes on. For poisoning substances, zinc white and copper are likewise to be considered, and other antiseptic remedies, such as hydrazine, etc., have been tried; copper and mercury were found to be the most effective. Copper is highly eligible on account of its cheapness, but it does not seem recommendable on account of the fact that, when the insulating layer becomes defective, large quantities of copper may bring about a corrosion of the iron.

Among the organisms growing on the hulls of vessels the seaweeds are less dangerous; they usually only grow at the water line, because light is necessary for their development. The movement of the vessel is mainly impeded by crustaceous animals adhering to it. These organisms, however, as a rule, only swim about during the first stages of their development. Thus the poisons in the paint have the mission to kill off the germs clinging to the vessel. During navigation the paint layer is so much softened by friction and the action of the sea water that the sea salts can enter into decomposition with the poisons in the coating. An antiseptic solution results on the surface which destroys the organisms touching it. In tropical waters the multiplication of life is so great in some seasons that the antiseptic agent on the surface seems to be soon exhausted and the paint can no longer prevent the growth. The quantity of organisms clinging to the vessel is larger during the sojourn in the harbor than during navigation. The effectiveness of the protective paints used, therefore, is chiefly dependent upon the length of time during the standstill of the vessel that these paints can give off an efficacious antiseptic substance. In port, however, the surface of the vessel is not subject to any friction; hence the antiseptic agents are already exhausted after a few weeks, and only become effective again when, during the renewed motion of the vessel, the exhausted particles are removed by friction, a new poison-saturated surface being exposed. According to the existing conditions, a newly painted ship may be more subject to become covered with growth than one covered with old coats of paint. It is of advantage to know that long exposure of the fresh coats to the air will materially decrease the efficaciousness of the paint composition. For the illustration of the value of the popular marine paints, W. P. Wierchowski has compiled the following table, based upon the experiments with the Black Sea fleet:

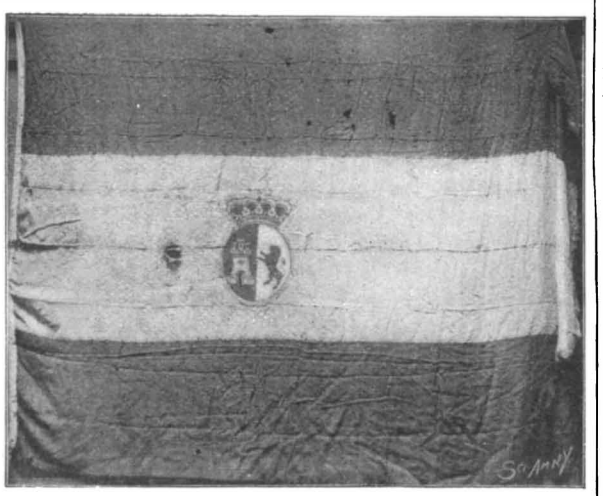
Compositions.	Quantity used in pounds per square fathom.	Cost. Rubles.	Weight of he adhering growth per month in pounds.
Leoni, Nos. 1 and 2.....	7·0	2·55½	3·704
Rahtjen, Nos. 1, 2, and 3...	6·18	4·95	3·191
Dubois, Nos. 1 and 2.....	7·5	3·72	5·453
Perreti, Nos. 1 and 2.....	7·86	2 90	4·358
Holzapfel, Nos. 1 and 2. ..	7·25	2·70	3·168
Murreo, Nos. 1 and 2.....	9 08	5·12	3·775
Sopston (Holzapfel).....	5·25	0·79	5·455
Urban, No. 1.....	6·0	1·80	2·82
Urban, No. 2.....	10·5	5·77	2·82
Meninge (minium).....	6·5	0·70	8·02

(Zap. imp. russk. techn. obschtsch, 1897. 31, numb. 6-7, 45.)

In spite of its eminent importance and the many propositions of remedies, the problem of an effective protection of the submarine parts of vessels from rust and growth still awaits its solution. Therefore the Russian Technical Naval Committee thought it wise to offer a large award for a suitable composition.—Chemiker Zeitung.

THE FIRST SPANISH FLAG CAPTURED AT MANILA.

Mr. Walter L. Beasley, of Chicago, Ill., sends a photograph of the first Spanish flag captured at Manila, which is of historic interest. He says it was captured at Cavité, Manila, and was sent to United States Senator Mason, of Illinois, by the crew of the "Olympia." The flag is 10 by 14 feet, and is rent by bursting shells



THE FIRST SPANISH FLAG CAPTURED AT MANILA.

and rifle bullets from the American squadron. The following letter accompanied the flag:

United States Flagship "Olympia," Cavité,
Philippine Islands, May 12, 1898.

To the Honorable W. E. Mason, Senator, Illinois, United States of America.

Sir: Please accept the accompanying Spanish flag in the name of the ship's company of the United States flagship "Olympia."

This flag was taken (after the destruction of the Spanish fleet) from the forts and arsenal at Cavité after the bombardment and surrender—Manila Bay, May 1, 1898.

This is sent as a token of our esteem for your patriotic utterances in Congress with regard to the "Maine" disaster, and which sentiments find a ready echo in the heart of every bluejacket serving under the star-spangled banner. Very respectfully,

Your obedient servant,
J. S. ECKSTROM, Chief Master at Arms.

Signed for the ship's company,
W. W. CREAGH, Chief Yeoman.

The Hellgramite.

The superintendent of small parks of the city of New York professes—so says The Times—to have made the discovery that the hellgramite, or "dobson," so well and favorably known as a "killing bait" for black bass, is not a specific form per se, but merely the larva of a form of butterfly. This certainly is interesting, if true. The superintendent is said to have discovered, on June 9, that a hellgramite in his possession turned white and immersed itself in mud; two days later it assumed a darker hue and gave evidence of wing development; June 25, the shell (cocoon) burst, and a butterfly escaped therefrom and was captured.

More information on this subject is desirable.

Corsets in Russia.

Bogoljewow, the newly appointed Russian minister of public instruction, has begun the duties of his office by issuing a drastic order to the effect that corsets must not be worn by young women attending high schools, universities, and music and art schools; they are to be encouraged to wear the national costume. The minister says that he has spent much time in visiting girls' schools, and has made the discovery that the corset as an article of dress is distinctly prejudicial to the health and physical development of the wearers.

Science Notes.

Every ton of Atlantic water when evaporated yields 81 pounds of salt; a ton of Pacific water, 79 pounds; Arctic and Antarctic waters yield 85 pounds to the ton; and Dead Sea water, 187 pounds.

C. MacMillan discusses the ecological significance of the orientation of the plant egg, and concludes that the phenomenon is at bottom one of adaptation. Three principal types of egg orientation are recognized: the primitive or bryophytic, characteristic also of Equisetum and Angiopteris; the semi-inverted, characteristic of Isoetes and the leptosporangiate ferns; and the inverted, characteristic of Lycopodinae and Spermatophyta.—Bot. Gazette, xxv., 301.

M. A. Mouneyrat has found that a mixture of acetylene and chlorine, exposed to diffused light, always combines to form acetylene tetrachloride without explosion, in the absence of free oxygen or any gas that might produce oxygen. If, however, such a gas be present, an explosion occurs, which the author attributes to the formation of acetylene monochloride, which takes fire directly it comes in contact with air.—Bulletin de la Soc. Chim. de Paris.

We learn from The British Medical Journal that the monument to Pasteur, which is to be erected in Paris in the space in front of the Pantheon, is now almost completed. M. Falguière, the sculptor, has introduced certain modifications into his original design, in which Pasteur was simply represented as overcoming Death, which was in the act of flight. Now a group of a mother with her child, thanking Pasteur, has been added on the right, while behind the central figure Fame is shown crowning him with laurels. The international subscription to the memorial amounts to nearly $65,000.

An argillaceous earth named "tfol," which contains free gelatinous silica, is largely used in Northern Africa by the Arabs as a substitute for soap in washing linen. Lahache finds that it has great capabilities of absorbing oil, one part of this substance completely absorbing five parts of heavy tar oil. When the compound is mixed with water a perfect emulsion is formed, which does not adhere to the sides of the vessel. It is proposed to employ this earth for the purpose of emulsifying heavy tar oil for disinfecting purposes. For this purpose the tfol is first mixed with an equal weight of water, and then intimately incorporated with sufficient heavy tar oil to make a paste.—Chem. Trade Jour.

It may be always worth while, says "M.D., Lond.," in The Lancet, to take note of even a minor accident to the eye, more especially when this may as easily be a serious one as it is preventable. Within my own experience I have more than once met with cases in which more or less damage has resulted to the eyeball or external canthus by the dragging up against it of the bar which, projecting backward from the frame of the ordinary pince-nez, serves to keep them folded. Of course one is aware that this accident must be more likely to occur when a cord is worn as usual, and also that it cannot happen with some forms of pince-nez; but it seems to me a pity that the more common form of glasses worn should not be rendered incapable of inflicting such an injury by this bar being placed in front of the folder instead of at the back, where, I take it, it would be quite as efficient. The simplicity of the mode in which the injury may occur and of its remedy may justify this note.

Further evidence of the existence of man before the glacial period in England has come to light, says The Independent. In his address before the Geological Society, of London, Dr. Hicks states that the evidence which has been obtained from bone-bearing caverns at high elevations in the glaciated regions in England shows conclusively that the remains of the extinct mammalia found in them must have been introduced before any of the glacial deposits now in or upon them could have been laid down, therefore either before or so early in the glacial period that there could not have been at the time any considerable amount of snow on the neighboring mountains, or glaciers even in the higher valleys. From caverns, he says, in glaciated areas in North and South Wales, where paleolithic implements have been found in association with remains of extinct mammals, facts have been obtained which make it certain that the implements were those of man living at the same period as the extinct animals in those areas, and therefore of pre-glacial age. It has also been shown that as the cold increased, the higher valleys became filled with glaciers, and the caverns became uninhabitable. Afterward, as the snow-line and glaciers descended lower and lower, some of the caverns were subject to inundations, which not only disturbed and rearranged the deposits previously in them, but wholly or partially filled them up with local materials. In one valley in North Wales the local glaciers gradually united with those from the western and northern areas, and a mixed material was distributed over the region to a height of over 600 feet, burying the bone caves beneath it. These caves were inhabited by hyenas.

© 1898 SCIENTIFIC AMERICAN, INC.

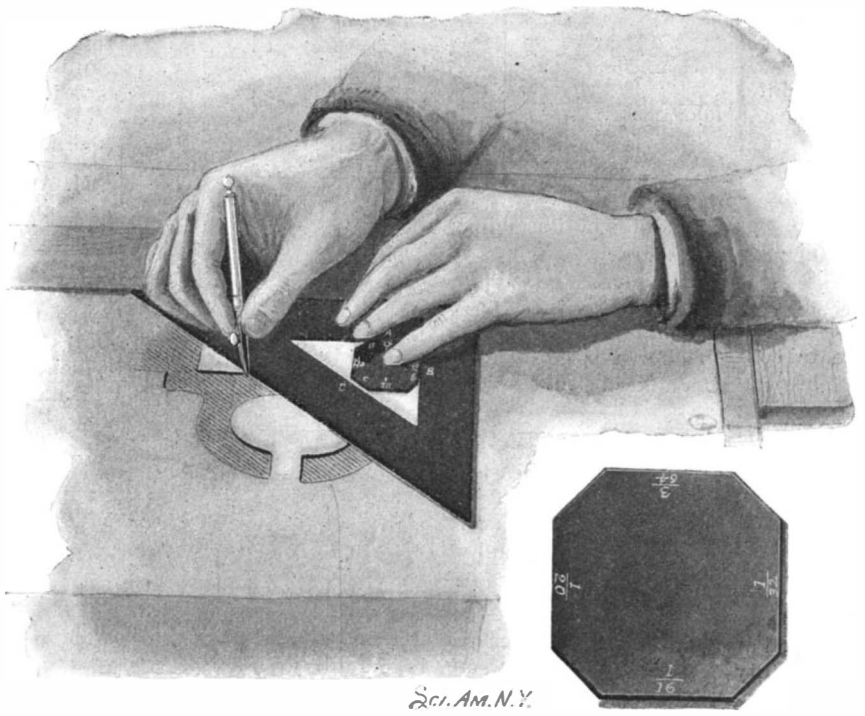
SIMPLE SECTION LINER.

This device consists simply of an irregular, octagon shaped block, to be used in connection with an ordinary draughtsman's triangle. It is slightly thicker than the triangle for which it is intended, and it is formed with reference to the triangle with which it is to be used.

The block is first cut square and a little larger than the inside opening of the triangle, as shown in the engraving. The corners are then cut down to such a distance that when the sides, a, b, of the block exactly coincide with the inside edges, A and B, of the triangle, the faces, c, of the block and C of the triangle will be the same distance apart as the lines in the required section. As there are four corners, four different distances may be obtained.

To use this device, the triangle is placed against the T-square in the regular way, and the block is placed in the center opening of the triangle. After drawing a line, the block is pushed back with the little finger while the triangle is being held with the other hand; then, by resting the little finger on the block, it may be held firmly while the other hand pushes the triangle back. Then the next line is drawn and the operation repeated for each succeeding line.

EDWIN J. NEWTON.



NEWTON'S SECTION LINER.

Vestadium.

Vestadium is the name of a recently discovered white metallic alloy of a beautiful appearance and great strength, says the Werkstatt. It seems to meet with as quick and general an acceptance as was the case with aluminum. It is said to be firmer and much more practical than any other known metal of equal specific gravity. It is claimed to be composed chiefly of an aluminum alloy, and only weighs one-third as much as aluminum of the same size. Furthermore, it is said not to rust, to withstand sulphuric acid, to take a fine polish, never to tarnish, and once polished, never to require cleaning.—Deutsche Maler Zeitung.

Groundless Fear of Lightning.

A current news item gives the result of an investigation carried out by Dr. G. Stanley Hall, president of Clark University, on the things that most excite fear in people. Of the 298 classes of objects of fear to which 1,707 persons confessed, thunder and lightning lead all the rest, although in certain localities, as, for instance, those subject to cyclones, etc., the fear of the latter predominates. It may be accepted as probably true that thunderstorms constitute the most pronounced source of fear with the majority of people, due, no doubt, to the always impressive and not infrequently overpowering nature of the phenomenon. But is there any justification in fact for this fear so far as fatal results are concerned?

We believe there is not, but, on the contrary, that many other causes which barely have a place in Dr. Hall's list are infinitely more entitled to the distinction as fear producers than lightning. As proof of this we may cite statistics of the United States Weather Bureau. These show that for the four years 1890–93 the deaths from lightning numbered 784, or an average of 196 a year. Again, H. F. Kretzer, of St. Louis, found from the record of nearly 200 newspapers that for the five years 1883–88 there were 1,030 deaths caused by lightning, or an average of 206 a year. We doubt whether, of the number of deaths classed as "accidental" in the whole United States, any one group can show so small a number. In New York city alone over 200 people are drowned every year, while nearly 150 are burned or scalded to death, and close on to 500 persons meet their end by falls of one kind or another. Comparing the record of 200 lightning fatalities for the whole country with the above records for New York city, with its total of nearly 1,500 accidental deaths for every year, it will be seen how groundless is the popular fear of lightning. It is a survival, an inherited superstition.

But there is another point in connection with this matter which ought to be particularly comforting to city dwellers, albeit country dwellers may not be affected in like manner, and that is, that statistics show that the risk of lightning is five times greater in the country than in the city. The cause of this immunity for city dwellers is not far to seek. It is doubtless due to the predominance of metal roofs, the well grounded water pipes in houses, and probably as much as anything to the protective network of overhead electric wires of all kinds. The popular belief that a stroke of lightning is invariably fatal is also not borne out by facts. Indeed, one record specially devoted to this feature shows that of 212 persons struck, only 74 were killed. Taking it all in all, there seems to be no more groundless popular fear than that of lightning. Indeed, if one can go by statistics, the risk of meeting death by a horse kick in New York is over 50 per cent greater than that of death by lightning.

Yet with all the weight of statistics against its deadliness, lightning will probably continue to scare people as heretofore. Perhaps, after all, there may be a more direct cause than the mere psychological one usually ascribed to it, and that is the fact that many people of nervous temperament are affected hours before the approach of a thunderstorm and thus rendered particularly powerless to stand the strain which more or less affects the most phlegmatic natures during a disturbance in the heavens.

Rats and the Plague in India.

The evidence for the part played by the rat in the propagation of plague is gradually accumulating. At Karachi it has been a comparatively common observation for the occurrence of a case of plague to be preceded a few days by the finding of dead rats; this was particularly noticed in the first two or three cases of the present outbreak. The finding of dead or dying rats has now become the signal to clear out of any dwelling. Mice and cats have also been found to suffer from plague. Although so much attention is given to the disinfection of clothing, the evidence that the contagion is ever conveyed by this means is very doubtful. The conveyance of infection by infected rats in grain-bags is much more probable, as dead rats have been found among the piles of imported bags. As nearly every house in an Indian town is honeycombed by rat runs, and as the disease is very virulent in this species of animal, it is reasonable to assume that it is by their means that the disease is extensively if not chiefly spread. It is very certain that contagion from the sick to the healthy only accounts for a small proportion of cases. There is some evidence to show, however, that the so-called pneumonic form is more infectious than any other.

The number of cases reported in Calcutta is gradually increasing, but the great exodus of people and perhaps the hot season may have combined to postpone its spread; the people are now beginning to get over their fright and are said to be returning, and are also learning to see that the sanitary measures adopted when a case of plague is discovered are not so dreadful as they supposed. In Bombay the plague is almost extinguished and the average weekly mortality is nearly reached. In Karachi it is also very rapidly diminishing, the majority of the cases which are now occurring being found in the outlying camps. There is very little elsewhere.—The Lancet (London).

Coronium in the Earth.

Prof. Nasini, of Padua, Italy, has communicated to the French Academy the results of his investigation of gases issuing from the earth in volcanic districts. Among these gases he found coronium, which has hitherto only been known hypothetically as a constituent of the sun. Coronium seems to have a vapor density far smaller than that of hydrogen. Prof. Nasini's investigations suggest the probability of the presence of other new elements.

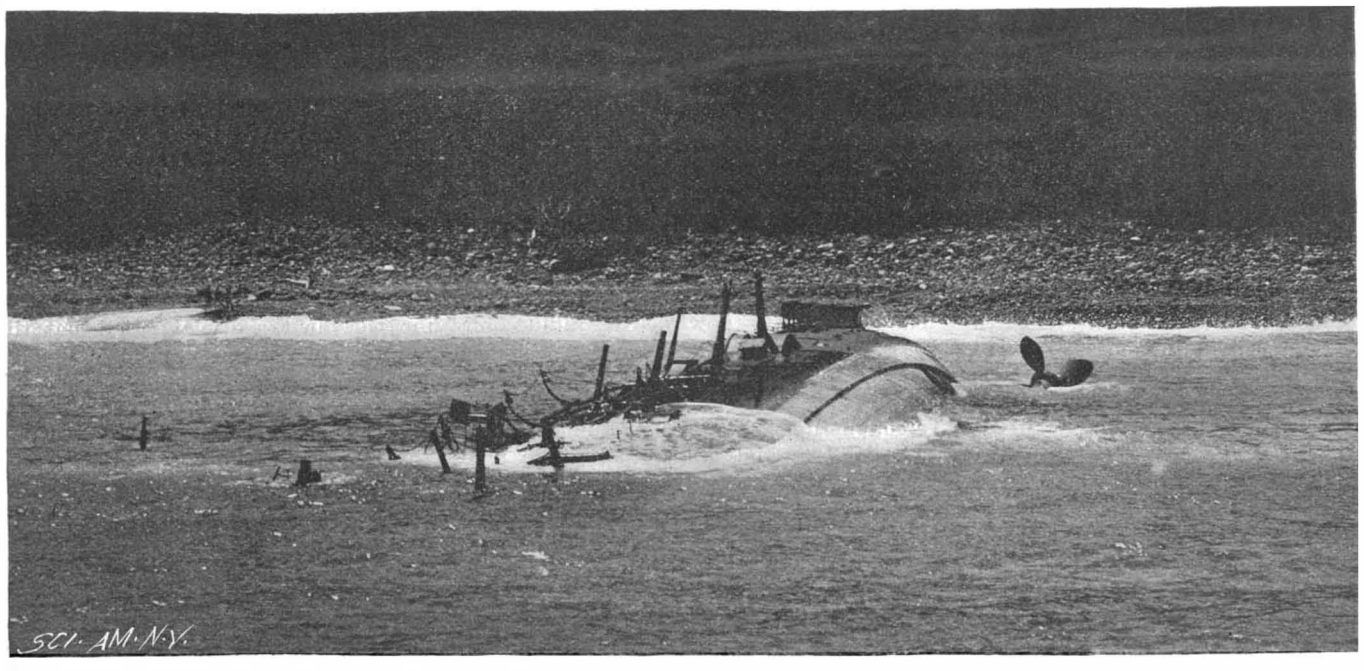
Prof. Schuster, from an examination of the spectrum of "metargon," is inclined to doubt that it is a new element. He thinks it is a mixture of the components of the atmosphere which solidifies at the temperature at which air liquefies.

THE REMAINS OF CERVERA'S FLEET.

Now that the smoke has cleared away from the naval battle off Santiago, the official report of the action by Admiral Sampson is being impatiently awaited.

Besides the torpedo boat destroyers "Furor" and "Pluton," Admiral Cervera's fleet was made up of four swift armored cruisers of modern design, viz., the "Almirante Oquendo," "Infanta Maria Theresa," "Vizcaya," and "Cristobal Colon." The first three are "sister ships," launched at Bilboa in 1890 and 1891. The "Colon" was built in Italy in 1896, and prior to her purchase by the Spanish government was known as the "Giuseppe Garibaldi II."

The "Oquendo," "Maria Theresa," and "Vizcaya" were known as 7,000-ton ships; were 340 feet over all, 65 feet beam, 21·5 draught, 13,000 horse power, and supposed to be capable of a 20-knot speed. They were alike protected by steel waterline armor belts 5·5 feet wide and 10 to 12 inches thick, and each also carried two turrets of 10·5-inch steel; the gun mounts of the broadside armament were protected by 5·5-inch steel, and the deck platforms by 3 inches of iron. Also heavy armaments were carried, each mounting two 11-inch breech-loading rifles in turrets, besides small batteries, and ten 5·5-inch broadside Hontoria guns—these latter, in the "Vizcaya," had been replaced by rapid-firers. Each vessel was also provided with six torpedo tubes.



Photographed by J. C. Hemment.

"CRISTOBAL COLON" ON HER STARBOARD BEAM-ENDS.

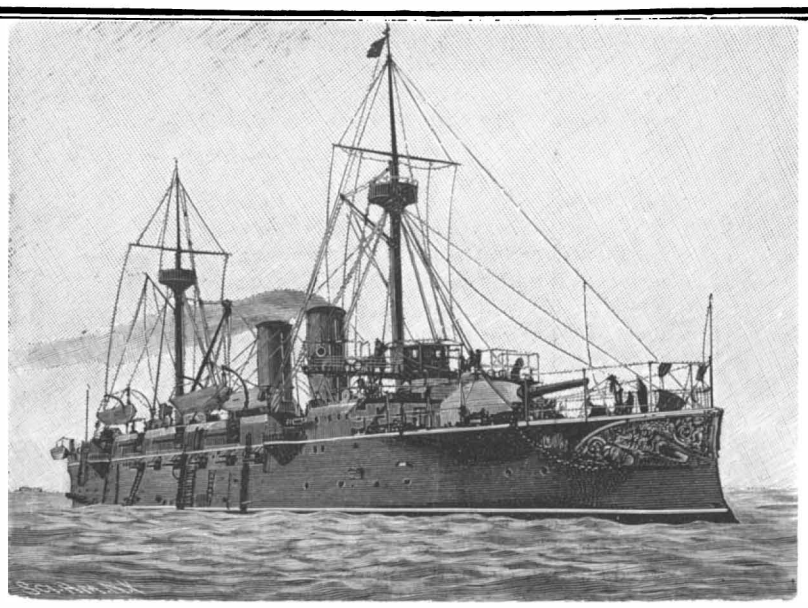
Copyright 1898 by W. R. Hearst.

The "Cristobal Colon" is 328 feet long, 59·75 beam, 24 feet draught, 14,000 horse power, and, it is said, has made a speed of 20 knots. She is accredited with two 10-inch breech-loading rifles mounted in turrets, ten 6-inch rapid-firers, six 4·7-inch, ten 2·2-inch, ten 1·4-inch, and two machine guns, besides four torpedo tubes; and her armor consists of a 6-inch waterline belt of Harvey-

© 1898 SCIENTIFIC AMERICAN, INC.

ized steel, 6 inches of steel on the gun positions, and a 1·5-inch steel deck.

The accompanying illustrations, from photographs made hastily with a large sized camera held in the hands by Mr. John C. Hemment on the morning of July 4, less than twenty-four hours after the conflict, show very vividly the effect of the heat caused by the fires started by the explosion of shells and ammunition on the decks. Each of the vessels was painted black, yet it is noticeable after the battle the ironwork above the protected main deck is white, with irregular shaped spots here and there, while below the main deck just above the water the original black color is preserved. This is accounted for by the great heat blistering or burning off the second coat of black paint on the thin metal composing the upper works, leaving the primary coat intact. But the thick armor below this deck prevented the heat from radiating so quickly, therefore there was no burning of the paint. The different views show the similar positions of the wrecked ships.

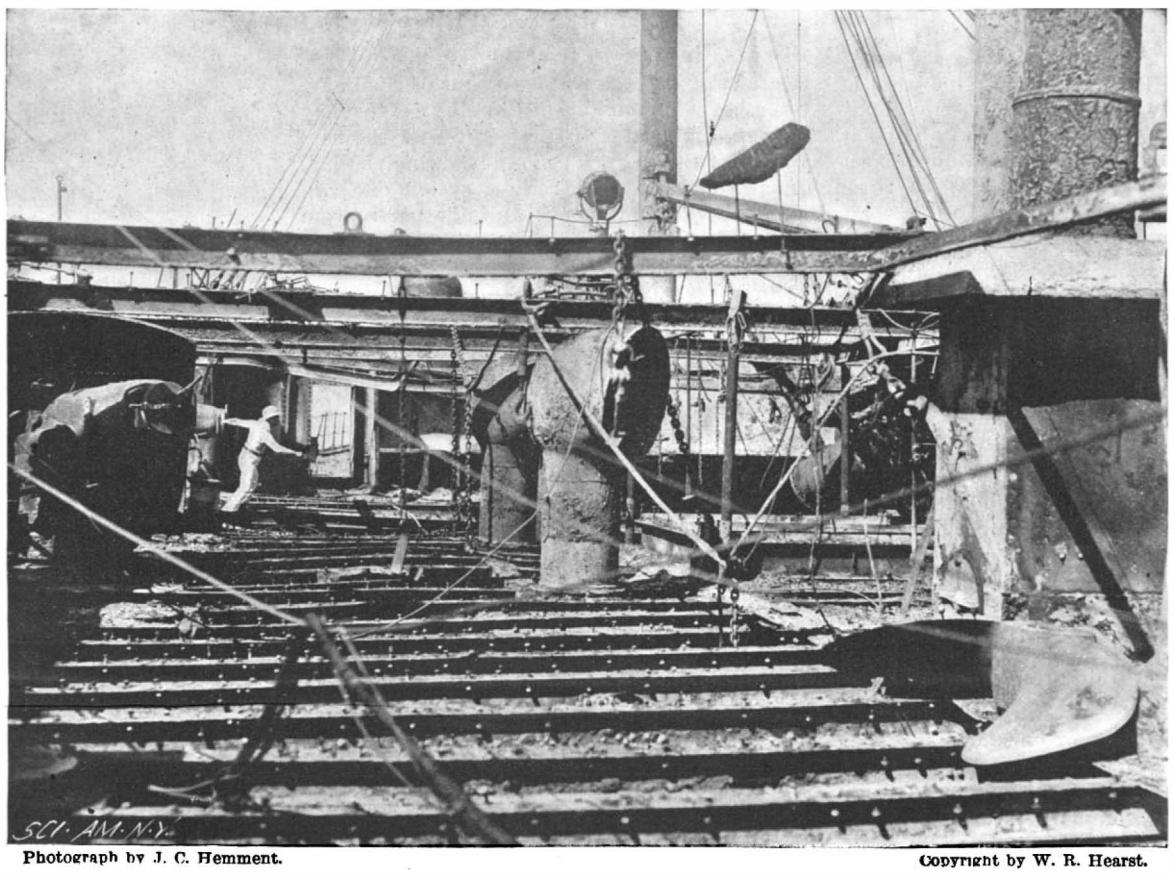


THE "VIZCAYA" (ALSO "OQUENDO" AND "MARIA THERESA") BEFORE THE ENGAGEMENT.

The "Infanta Maria Theresa," which led the line in the attempt to escape from Santiago, is stranded some five miles west of the entrance to the harbor. Though her hull is practically intact, all superstructure and woodwork on the main deck have been swept away by fire or shot; she was struck thirty-three times above the waterline. The very first projectile practically disabled her, as it destroyed the fire mains, making it impossible to extinguish the flames in the after part of the ship, that were started by the explosion of a second shot in the admiral's cabin. A third projectile cut the main steam pipe on the port side, thereby rendering the port engines useless; and the steam killed all who were in this room. A mass of blackened, battered, twisted ironwork, one military mast cut down and lying athwartships, the last vestiges of woodwork consumed, this once handsome ship looks like a rough, battered, empty shell of iron.

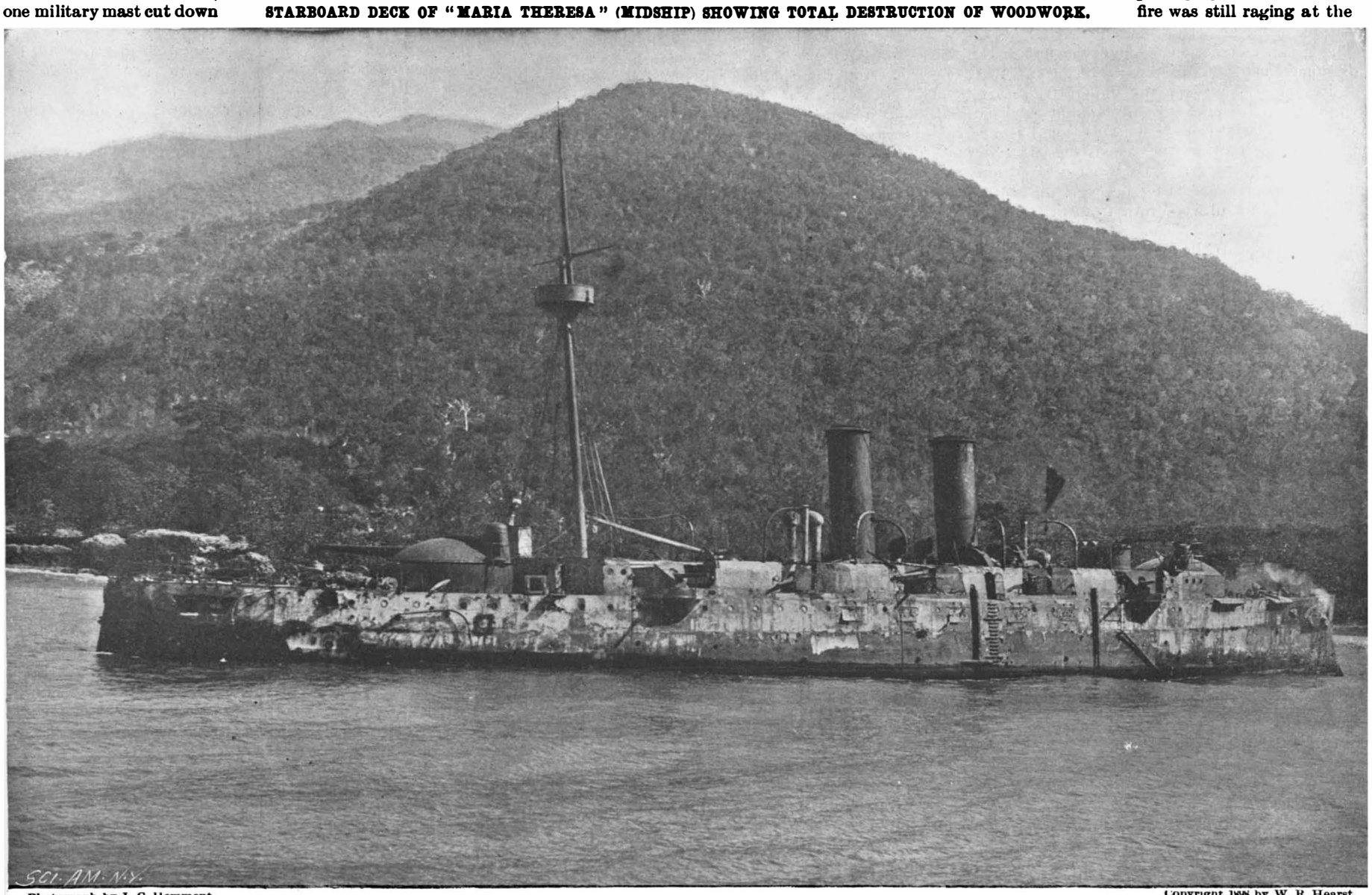
Her frame and deck beams and most of the plates of the hull are left intact, however, and it is hoped she will be saved to become an ornament to our navy. Her after military mast, which still stands, is the only mast in the fleet that survived the battle. A glance at the illustration evidences how completely the fire did its deadly work, even the deck having been eaten away as the fire progressed.

A mile west of the "Maria Theresa" lies the "Almirante Oquendo" with broken back and a fearfully battered hull. Being the second to leave the harbor, she was much exposed, which accounts for her serious punishment; she was hulled above the waterline no less than 66 times. Our illustration exhibits her starboard quarter and the destruction by fire of everything combustible, leaving a mass of whitish-gray ashes all over the blistered sides and armored deck. One of the first shots that struck exploded the torpedoes in the after torpedo compartment and set the ship on fire; and as she headed toward the beach, shell after shell swept clear through her. One big hole amidships was caused by a 13-inch shell fired by the "Texas;" and near this is another notable injury, in that a projectile ranged downward from the gun deck, penetrating several bulkheads, exploding only when arrested by the armor belt at the starboard side. One can look clear through the ship along its course. There is abundant evidence that several other large shells exploded within the hull, causing great devastation; and presumably an armor-piercing shot struck one of the Hontoria guns, as it exhibits a groove an inch deep cut cleanly along its length. At the time this photograph was taken the fire was still raging at the



Photograph by J. C. Hemment. Copyright by W. R. Hearst.

STARBOARD DECK OF "MARIA THERESA" (MIDSHIP) SHOWING TOTAL DESTRUCTION OF WOODWORK.



Photograph by J. C. Hemment. Copyright 1898 by W. R. Hearst

THE "MARIA THERESA" WITH MILITARY MAST STANDING AND SMOKE ISSUING FROM BOW.

© 1898 SCIENTIFIC AMERICAN, INC.

bow, as will be seen from the great cloud of smoke rising therefrom.

The "Vizcaya" managed to get considerably further to the westward than the "Theresa" or "Oquendo," as she lies beached about fifteen miles from Morro; and though only hulled twenty-four times, she is, nevertheless, a complete wreck. The illustration exhibits a starboard broadside view, and the large hole in the bow was caused by a shell striking from the port side and exploding the torpedoes in the forward torpedo compartment; the effect is hardly appreciable when the injury is viewed from the exterior, since no idea can be had of the broken and shattered forefoot beneath the waterline, or of the explosive force that extended so far aft as to blow the forward military mast out of the ship. The rolling back of the hull plates proves conclusively the outward character of the explosion, so different from that of the "Maine," which was upward. It strengthens the belief that the latter was certainly wrecked by external mines.

One 13-inch shell struck the port armor nearly amidships, tearing out half the side; and another shot of lesser size entered well aft in the cabin, and passed through, tearing off plates on the starboard quarter. These wounds do not show in the photograph, as they are located on the port side.

The "Cristobal Colon," owing perhaps to better management and greater speed, and the fact that she was shielded by other vessels of the fleet, was struck only eight times, and succeeded in running forty-eight miles down the coast before she was beached, the purpose then being manifestly to keep her from falling into the hands of the foe. She lies on her starboard beam ends, her port battery pointing to the zenith, and before grounding all her sea-cocks and Kingston valves were opened, dead-lights smashed, ports and torpedo tubes cleared—in fact, every effort was made to afford ready ingress to water. Fortunately she lies in only four fathoms of water, and there is some hope that she will ultimately be raised. Evidently she largely escaped the havoc wrought in other ships owing to her belt of Harveyized steel armor, which kept out the shots from small and secondary batteries. Only two serious hits are apparent, one from a 13-inch, the other from a 9-inch shell. A second 13 inch missile exploded on her armor without material injury, and the nose of a smaller projectile is lodged in her bow armor. Our view of her was taken some distance away, but it will be observed that her stern swung around toward the shore as she sank, leaving her battle or port side upward (her secondary battery guns pointing upward) and her port propeller out of water. The shore all along is quite precipitous, which accounts for her strange proximity thereto.

As soon as official information, following careful examination by experts, is received, it is hoped that some definite knowledge may be reached bearing on that all-important question of armor plate and the destructive force of the modern projectile.

The great destruction wrought by fire, not only in this engagement, but in the action of the Yalu, emphasizes more than ever the imperative necessity of stripping our warships of all inflammable material. As we saw in last week's issue, this has been carried out to some extent in the reconstructed "Newark" and "Chicago," by removing wooden partitions and substituting corrugated iron between the staterooms, and by removing all woodwork from proximity to the guns.

We shall take up the lessons taught by the engagement at greater length in an early issue.

The Current Supplement.

The current SUPPLEMENT, No. 1178, contains a number of articles of great interest. "The Opposing Leaders in the Philippines" is illustrated by a group showing Aguinaldo and the chiefs of the revolt in these islands. "Porto Rico: Its Natural History and Products," is a timely article in view of the expedition which is now being made to conquer it. "The Preparation of Meat Extracts" is an important article on a subject of which there is little literature. "The Art of Taxidermy: Mounting Large Animals," is an illustrated review of Mr. John Rowley's new book. "The 'Telectroscope' and the Problem of Electrical Vision" describes an alleged invention for transmitting visual images invented by Szczepanik. There are many other articles of considerable interest which will be found listed in the Table of Contents on page 66.

LYNDE BRADLEY, of Milwaukee, has devised plans for the use of the X-ray on board of war vessels and on the field. Mr. Bradley says that while it would be a simple matter to bring the X-ray into use on a warship, considerable difficulty would be attached to the introduction of the apparatus on the field. A small outfit would have to be mounted on wheels for field use. The apparatus would, however, be much lighter and more portable than may be imagined, and his field apparatus could be finished in a week. The great help that the X-ray would be to surgeons lies in the quick method of locating a bullet or splinter in a man's body, a fracture, or other serious injury.—West. Elect.

The Trans-Siberian Railway and Siberian Colonization.

The director of that stupendous enterprise, the Trans-Siberian Railway, announces the whole line will be opened to traffic early in 1904. It will then be possible for the "globe trotter" to circle the earth in thirty days or less. At present the great bridge, which, when completed, will be one of the most notable in the world, and more than seven miles long, across the Yenisei, is well under construction. Next month, it is expected, trains will run through from Moscow to Irkutsk, when a big scheme of colonization, already fully arranged for, will be begun. Two hundred thousand families, or, approximately, one million individuals, will be transported by the Russian government, free of all expense, from the famine districts in European Russia to the fertile valleys of the Angara, Vitim, and Upper Lena, and the districts about Lake Baikal, where each head of a household will receive a grant of about fifty acres of land along with the necessary seed and agricultural implements; also the means of sustenance, housing, and clothing for one year. This undoubtedly is the greatest colonization scheme the world has ever known.

Railways and the Telegraph in Spain.

Both the railway and telegraph systems of Spain are in a very unsatisfactory condition and give rise to many complaints, especially among foreigners, and they are both examples of the pernicious methods which run all through Spanish affairs. The railway system of Spain comprises about 7,500 miles of road, built partly from private capital and partly from the proceeds of government subsidies, which, up to the present time, amount to more than $200,000,000. Most of the roads were constructed under the supervision of the French and English engineers and the securities have been very gradually absorbed by French investors.

The speed of the trains is very low. The express trains run on only a few of the lines and even the "trains de luxe," which run only first class carriages, with the fares raised by 50 per cent, seldom run faster than twenty-five miles an hour, while the ordinary trains never attain a speed of more than fifteen miles an hour and are often behind time, specially in the southern part of Spain. Tourists usually select the first class carriages, which are fitted up like those in France, but they are by no means as comfortable and clean as they should be, and on the main roads they are often overcrowded. The number of seats is six or eight, and some of these are often occupied by the conductors of the train and even railway laborers, who scramble into the train between stations, much to the disgust of the passengers. Every train is supposed to have a first class compartment reserved for ladies and another for those who do not smoke, but the latter injunction is seldom heeded by the Spanish travelers; but this is an evil which is by no means limited to Spain, for in Holland it is almost impossible to prevent travelers from smoking in every compartment. The second class carriages on the Spanish railways have narrow and uncomfortable seats for ten persons and are generally dirty and neglected. The third class carriages are, of course, impossible for foreigners, and they have sometimes seats on the roof which are used exclusively by the lower classes.

In winter the carriages are heated by foot warmers. At nearly all railway junctions there are restaurants, but those who prefer to eat in a more leisurely manner may provide themselves with food to consume in the railway carriage, but in this case the Spanish custom demands the formality of asking your fellow passenger to share the meal with you.

At the larger stations the luggage office closes a quarter of an hour before the departure of the train; so this necessitates the traveler being on hand much before the proper time. In some cases there are no waiting rooms, and where there are, passengers are not allowed to enter either the waiting rooms or platforms unless they have their railway tickets. The railway officials have not seen fit to pay much attention to issuing return tickets, which are such a source of revenue in Italy and other countries. Such tickets are only available for one or two days and are issued on a few lines only, and the reduction in the fare is generally insignificant. Circular tour tickets are not unknown, but these tickets for combined tours in France and Spain have been discontinued, owing to the unstability of Spanish currency.

If the traveler has trouble with the railroads, he will have much more with the telegraph offices. Our conception of a telegram is a message which is sent on at once by wire, but the Spaniards divide their telegrams into two divisions, urgent telegrams, for which are paid thrice the regular rate, and those which are sent in the ordinary way. The smaller railway stations have private telegraph offices and the rates are higher than the regular telegraph offices. The rate for a domestic telegram is one peseta (twenty cents) for fifteen words, and each additional word is charged at one-tenth of this sum. Messages in the same province have lower rates. Telegrams may be sent to foreign countries, but an additional fee is paid on each foreign dispatch, and it is advisable to take a receipt, which is charged for. Telegrams are paid for with postage stamps, but money is accepted at the railway offices.

Typhoid and Ice Cream.

Not in all ice cream, but in some forms of this seductive and frigid congelation, lurks an element of danger—one predisposing to disease and fatality. The fact that cheap ices are continually hawked about the streets by the dirtiest of all dirty itinerants is itself sufficient evidence, aside from the fact that medical practitioners have given voice to frequent and oft-repeated warnings. Boards of health have fulminated against the evil, and then have forgotten it all; charity organizations and societies designed for the protection and uplifting of the more indigent and least cared for of the human race, have decried the iniquitous traffic; nevertheless, it still continues to flourish. Since the revelations of Doctor Campbell Munro in 1893, who traced an extended epidemic of typhoid fever in Renfrewshire, Scotland, directly to the sale of cheap and uncleanly ice creams, not a year has passed without similar epidemics, from like cause, being discovered in America and Great Britain. The report of Doctor Munro shows that the ice cream was prepared on premises where was an unreported case of the disease, the patient being a girl who, for a considerable part of the time she was ill, had been in immediate contact with the business.

Several epidemics due to ices have been reported in Michigan, Wisconsin, Illinois, and seven middle and southwestern States. Mr. Harris, the medical officer of health for Islington District, London, England, caused samples of the ices sold upon the streets to be examined by Doctor Klein, the well known pathologist, who found all were swarming with pathogenic bacteria; and Mr. Harris' own investigations of the premises where the stuff was manufactured were equally startling: He found most of the ice cream vended by cheap peddlers was unfit for use; the methods of manufacture were of the filthiest, including the blowing of eggs, foul utensils employed, utter disregard of any measures looking to cleanliness, storing in evil-smelling rooms (also employed as sleeping apartments) and the use of stale and half-spoiled eggs and milk.

In most of the cities in the United States precisely the same conditions obtain. The itinerant cheap ice cream trade is almost wholly in the hands of the lowest grade of Italians, Polish Hebrews, and Armenians, among whom anything approaching sanitation, or even ordinary cleanliness, is unknown. Doubtless boards of health, in most instances, have the power to deal with this unrighteous traffic, but, either through ignorance or a supposed trivial character, it is generally ignored.

Typhoid is a filth disease, communicated almost always—if not invariably—through the fæcal excretion; this should be remembered. But it is not typhoid alone that is to be dreaded, for many of the contagious and infectious diseases may be disseminated in the same way; further, the stale milk and eggs are very provocative of forms of ptomaine poisoning that in its milder forms is assumed to be "bowel complaints" dependent on temperature changes, but in its more virulent phases leads to suspicions of mineral toxics employed for purposes of suicide or assassination. Many puzzling cases, especially among children, leading to fatality, doubtless have their inception in some such cause as this.

Little fear may be had regarding the wares of the reputable confectioner or caterer, however. The very character of his trade, the standing of his customers, etc., are such he cannot afford to conduct his business on any but the most sanitary and cleanly basis.

Government Ambulances.

In our last issue we described one type of government ambulance. We now understand that an Indiana firm of carriage and wagon makers has received orders for 500 Rucker ambulances since the outbreak of hostilities, and up to the present time they have shipped 316, and 50 are to be delivered weekly, until the order is filled. Under the front end of the wagon, and extending the full width of it, is a water tank 16 × 19 inches. The inside of the wagon is fitted to accommodate six persons. Two litters are made to fit in the bottom and they may be taken out when not in use. Two litters are also suspended from the top, leaving room for two wounded soldiers to be placed above their companions at the bottom of the ambulance. The ambulances are finished in natural wood. The same company also received orders for 1,000 army wagons; 500 of them have been delivered and the remaining 500 are being made.

The Hawaiian Islands as a Trade Center.

Now that the United States has annexed the Hawaiian Islands, intense interest is being manifested in the commerce of these islands. We shall, of course, now reap trade advantages as the result of their union with the United States; but it is a satisfaction to know that last year the people of Hawaii bought nearly $8,000,000 worth of goods from all parts of the world and over 75 per cent of these goods came from the United States.

© 1898 SCIENTIFIC AMERICAN, INC.

PUEBLO ARTS AND INDUSTRIES.—III.

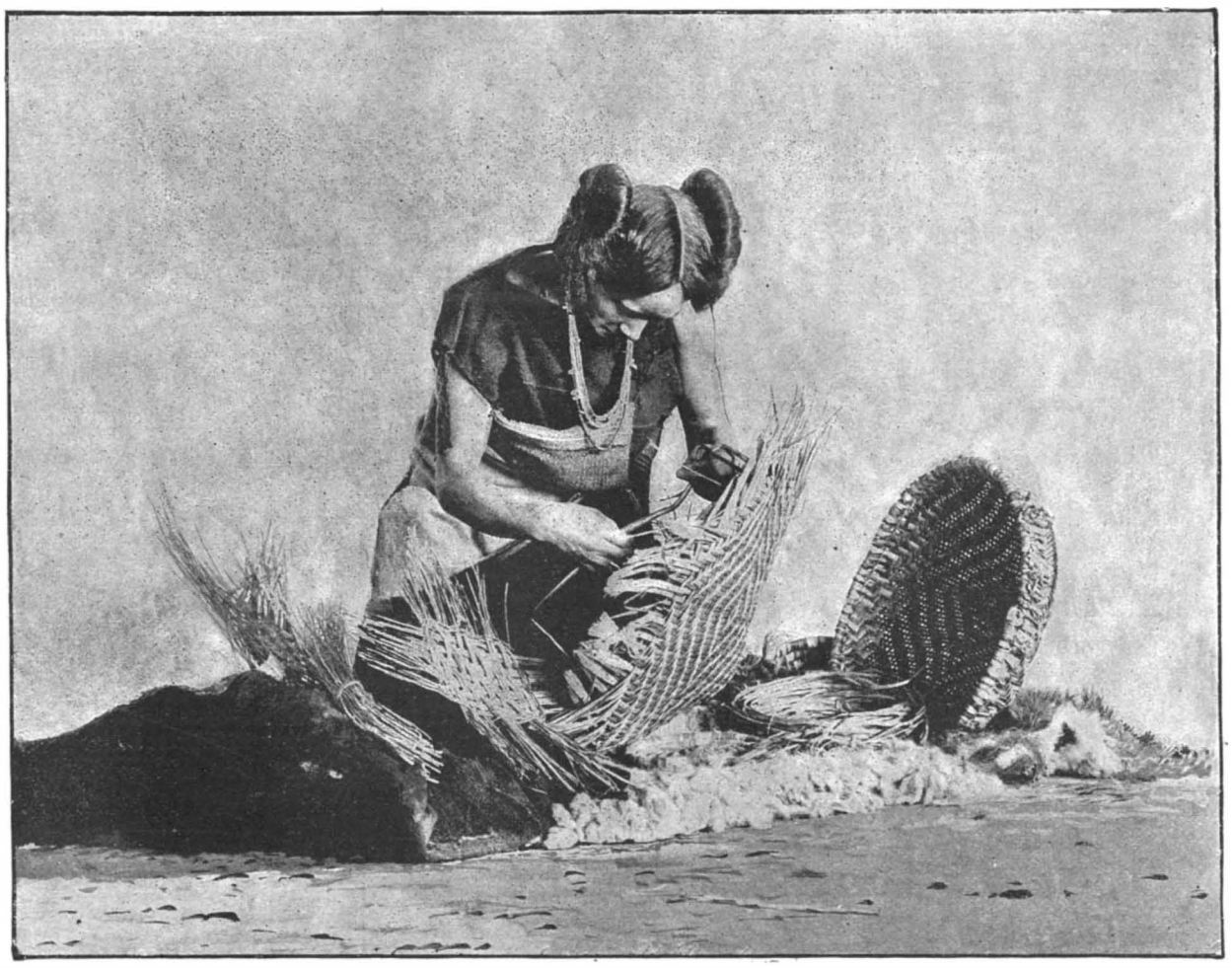
BY COSMOS MINDELEFF.

Although blanket and textile weaving is the art product which has made the Pueblo Indians most widely known, the allied or antecedent arts of basketry and pottery have equally developed. The conditions under which these people live are so simple and their methods are so primitive that the connection between the three industries is still apparent, even to the casual investigator. The elaborate blankets are a development from the simple baskets, and the fine pottery, easily the best made by any tribe in the United States, are little more than baskets of clay.

Of all the Pueblo tribes, the Mokis, or Hopi tribe, in Western Arizona, excel in making baskets. They have them of all kinds, varieties, and sizes, from the roughly made panniers of twigs designed to carry heavy loads upon the back to the fine plaques so closely woven that they will hold water, and ranging through all degrees of ornament. The introduction of beasts of burden, horses and burros, occurred at a much later date in Moki than on the Rio Grande, and even at the present day much of the carrying is done on the backs of men. As the villages are located on the tops of the mesas, 500 or 600 feet above the valleys where the cultivated fields lie, all the products, as well as wood and water, must be carried up to them. Constant practice has made the people perfect in the carrying of loads, and long strings of women can be seen any morning winding their way up the devious and difficult trails to the mesa summit, each loaded with a water jar filled from the wells below; while at the harvest season it is not unusual to see an old man loaded with two dozen or more watermelons in a huge pannier on his back, slowly toiling up the trail. One would think that such work would produce great muscular development, but it does not. The average Indian has no apparent chest muscles, and many a man climbs the trails to the villages loaded with over 200 pounds of field produce, and does it without distress, notwithstanding that he has no visible calves to his legs. A white man would break down at once under such work, but the natives are apparently inured to it.

PUEBLO POTTERY MAKING.

Food products of all kinds are stored in the houses in baskets, most of which are bowl-like or tray-like in form, like the examples shown in the illustration. These are usually made of the split leaves of the yucca, which are flexible but very tough, and in use last for many years. In making the basket the work is commenced in the center, as in the example shown on the left of the woman in the illustration, and the ends of the split leaves are turned over to form the finished edge, as in the finished specimen shown on the right. The pleats form a design like that seen in the picture. They are the everyday working baskets of the people and are seldom ornamented in any other way.



HOPI BASKET MAKER.

Notwithstanding the pre-eminence of the Pueblo tribes as makers of pottery, they do not use nor have they any knowledge of the potter's wheel. The largest specimens are formed like the baskets by coiling upon itself a fillet or rope-like piece of clay, pressing the coils together, and finally smoothing the surface and polishing it with a small pebble. The illustration shows the regular water jar in various stages of manufacture.

There is an abundance of fine clay throughout the Pueblo country, and practically every village makes its own pottery. The work is usually done by the old women, who break up and work the clay, mixing with it a small percentage of fine sand and a proportion of pulverized potsherds, obtained preferably from some ruin in the vicinity, where bushels of pottery fragments can be picked up. When the clay has been put in good condition, it is rolled out into fillets and coiled upon itself like a rope. The base or commencement of the coil is placed in one of the flat baskets before described, and the pot remains in this basket until it is dry enough to handle. In some antique specimens of pottery obtained from ruins which were inhabited at the time of Coronado's expedition, and which are the finest specimens of aboriginal pottery so far found, the print of the basket in which the jars were moulded can still be seen upon the bottom.

Ordinarily no such marks are to be found. As the coils of clay are laid on they are pinched together with the finger and thumb, and the surfaces, interior and exterior, are rubbed smooth. Wonderful uniformity of thickness, seldom exceeding an eighth of an inch even in a large piece, is obtained in this very primitive way. In one type of jar, common in antique specimens but still made to-day, the exterior surface is not smoothed, but shows all the thumb marks. Sometimes these are arranged so as to form geometrical designs, but usually all such marks are carefully obliterated and the surface is smoothly polished with a hard pebble. An elaborate design, usually geometrical in character, and closely similar to those on the baskets, is painted on the smooth surface, commonly in black, sometimes in black and red, rarely in complex patterns in other colors. The pots are burnt in the open air, a good day being selected, and careful attention is given to them until the operation is completed. Very few pots are lost in burning.

What the ancient practice was in burning pottery has not yet been determined. At the present day compacted sheep dung is the material used, and this is taken from the corrals where the sheep are placed every night. In course of time a well compacted layer of the material is formed in the corrals. This is taken out, dried, and stored for future use. When the vessels are ready to burn, they are stacked up in some place, away from the village, well sheltered from the wind, and the dung is placed below and around them. It burns slowly, with a steady heat, and the fire is carefully attended by the old women, who spread blankets and screens on the windward side, until the operation is completed.

In the Indian system of belief, animate spirits inhabit inanimate objects, and, in the manufacture of such objects, the idiosyncrasies of the spirits must be considered. Thus, in burning pottery, certain things must be done, or the process will result in failure. Practically, every jar or bowl which is decorated has a line about its neck or mouth. But this line must never be complete; it must be broken somewhere to permit the egress of the spirit of the pot. If this is not done, the spirit, in struggling to escape during the burning, will rend the piece to fragments. Similarly, in the coiled baskets, the end of the coil must be left unfinished, or serious trouble will result.

When a pot is no longer wanted for use, as, for example, when it is placed upon a grave, it is "killed" by punching a hole in the bottom. The variety and detail of this belief is almost infinite, and can only be alluded to here.

IN Brussels, Belgium, the payment of a special fee of 3 cents secures immediate delivery of a letter, postal, or parcel by a bicycle postman.—Uhland's Wochenschrift.

© 1898 SCIENTIFIC AMERICAN, INC.

Gold Beating.

BY O. G. HOLT.

Imagine a 5/8 inch cube of pure gold that could rest on one's thumb nail being hammered and expanded until it would cover the floor of a room 12 feet square, or an area of 144 square feet—or a mite of the precious metal of the size of a pin's head being flattened and extended to 25 square inches—and some idea may be gained of the wonderful ductility of this most beautiful and costly of all the metals. Few, perhaps none, of the arts have come down to us from mediæval periods with so little change as that of gold beating. Three thousand years ago it was practiced in all essentials as it is to-day, for the coffins of Egyptian mummies are ornamented with gold leaf as thin and fragile as that of modern days. Machinery has never been able to successfully supplant the time-honored process of hand work.

It is supposed by some that an alloy of the baser metals is essential to a great reduction of gold, but this is not so. On the contrary, alloys tend to lessen its malleability. Hence, as gold leaf is sold by superficial measurement rather than by weight, there would be little or no advantage in using an alloy simply on the score of economy; but it imparts to the metal greater rigidness and lessens the liability to adhesion to the leaves of parchment or paper between which it is beaten. The alloy is also essential in giving a desired color. Taking 1,000 as the standard of purity, the gold used in the beater's art is from 960 to 985, or about 22½ carats, 24 carats being taken as the standard of purity.

The alloys used are silver and copper, in varying proportions, according to the color desired: for red gold, copper is freely used as an alloy; for pale yellow, a small quantity of silver, etc. The workman having decided on the color desired, places the gold with its alloy, together with a small quantity of borax and sometimes corrosive sublimate, in a small crucible and fuses the mass, subjecting it to greater heat than is necessary to merely melt it, in order to increase its tenuity. When sufficiently heated it is poured into a small cast iron mould coated with what is technically termed "brime," being usually burnt talc, which prevents the gold from adhering to the mould when removed. This ingot is usually 1 inch wide, 5 inches long, and 3/16 of an inch in thickness and weighs about 50 pennyweights, or 2½ oz. Troy. In some establishments in this country the ingots weigh 55 pennyweights. The ingot is next annealed by being hammered on an anvil and then placed in a coal fire and brought to a red heat and allowed to cool, after which the laminating process follows, which consists in passing the gold through steel rollers several times, the rolls being gradually brought closer together to reduce the thickness of the metal until the little ingot is transformed into a ribbon from 7 to 8 yards in length, the width remaining 1 inch, as at first. The workman then, with his shears, cuts the ribbon into little sections 1 inch square.

These pieces are next placed between small sheets of very tough paper, manufactured chiefly in France and Germany. These sheets or leaves are 3½ inches square and from 180 to 200 in number. The package is known to the trade as a "kutch." The small pieces of gold are placed exactly in the center of the paper, so that the edges form a vertical line. This is essential to a uniform expansion of the metal in the process of beating. Next, a "band" or case of tough parchment, open on two sides, is drawn over the packet and another case over this, covering the two edges left exposed. An anvil of marble or granite, 9 inches square, with its base resting on a foundation, sunk 2 feet in the ground to secure firmness, is employed in the beating process. The face of this anvil is surrounded by a hard wood table with raised edges on three sides, while in front, next to the workman, is a leather apron with an expanded pocket for catching waste particles of gold. The hammer used has a circular and slightly convex face, 4 inches in diameter, and in the first or "kutch" process its weight is 18 pounds. The blows, which fall with absolute regularity, are first directed to the center of the packet and then with lessened force toward the edges, until, on removing the bands, the little films of gold are found to have reached the edges of the "kutch," when the beating is discontinued. This process occupies about one-half an hour. The next operation is called "skewing," that is, the gold leaf is removed from between the leaves of the "kutch" by means of delicate wood pincers, wood being used because gold in this reduced state would adhere to metal. Each gold leaf is next divided into four equal parts, being cut by a tiny cane or bamboo appliance, having sharpened edges, called a "wagon." These subdivided pieces of gold are next placed between the leaves of a "shoder," similar in construction to the "kutch," except that the leaves composing it are vellum instead of paper; it is also somewhat larger, being 4 inches square and ¾ of an inch thick. It will be noted that now the original leaves of gold, say 180 in number, have been increased by cutting to four times that number, or 720.

The filling of a "shoder" requires one hour. Then the beating is continued with a hammer of lighter weight, usually about 12 pounds, for two hours. The sheets of paper and vellum, between which the gold is placed, are invariably coated evenly with the finest talc, or some similar material, to prevent the adhesion of the metal. During the beating process the workman changes the hammer from one hand to the other, and shifts the packet, but never varies the regularity and precision of the stroke. He also frequently "riffles" the leaf during the process, that is, he removes the bands or cases and bends and manipulates the package to prevent the gold from sticking to the sheets with which they are in contact. When the gold in this operation has been expanded to the edges of the "shoder" it is again subdivided, each leaf being cut into four parts, being now sixteen times thinner than it was in the first process; in other words, instead of the original 180 leaves of gold, there are now 2,880, but trimming and imperfect leaves reduces the final output of the "beating" to 2,000. These reduced pieces are placed between the leaves of moulds similar to the "kutch" and "shoder," except that the sheets are made of a skin of great tenacity, fine texture, and perfectly smooth surface. These skins are made from the large intestine of the ox: They are stripped off in lengths of 2 or 3 feet and treated to an alkali solution to free from grease, then thoroughly cleaned, and doubled by placing the two mucous surfaces together, which causes them to unite, after which they are treated to various chemical applications to increase the toughness and the better adapt to the purpose intended. This is the most expensive part of the gold beater's art, as no less than 350 to 500 oxen must be slaughtered in order to obtain enough skins for one mould. A mould can only be used for about 200 beatings, after which the skins are used for the "shoder," which does not require a membrane of such perfect texture. These moulds are more expensive than the gold they contain, each mould costing not less than $45. The contents of one "shoder," when divided as indicated, will fill three moulds.

The gold leaf having been placed in the center of the mould, as in the former operations, it is beaten for four hours with a 7-pound hammer; also during this process it is frequently annealed without removing it from the mould. When the final beating is completed, the gold is reduced to about 1/250000 of an inch in thickness, or at least 1,000 times thinner than ordinary printed paper—truly a marvelous result. The above is about the standard thickness of gold leaf employed for decorative purposes; for dentistry it is much thicker and without alloy.

Following the final beating of the gold is another operation called "booking," done by girls, as their fingers are supposed to be more deft and delicate than those of boys. In some establishments the leaf for "booking" is sent to the homes of the girls, where the work is done, but this is not general. The finished leaf is taken with the slender wood pliers and placed between leaves of tissue paper coated with red chalk applied by a soft brush; the chalk prevents adhesion. Gold leaves to the number 25 constitute what is technically called a "book," and 20 books make a "package"—that is, 500 leaves. The standard weight of a book is exactly 5 1/10 grains of gold. Thus the original ingot weighing say 50 pennyweights (2½ oz. Troy) has been manipulated for thirty hours, or three working days, and the final product is 80 books of 25 leaves each, with a rebate to the workman of the leaf trimmings, more or less, according to his expertness, for which "scrap" or trimmings he receives credit at the rate of $1 per pennyweight if in excess of a specified amount, and with a debit in a like sum if there is a shortage. The standard for a "beating" is 80 books. The most skilled workman rarely produces more than 160 books (two beatings) per week.

As gold leaf is not sold by weight, it is to the interest of both employer and employé to carry the expansion of the gold to the greatest limit, and now and then a workman becomes quite proficient in this direction; but the compensation at best is small, $3.20 per beating being the present standard of wages in the United States. This would only yield the best workmen $6.40 per week, which, of course, would be supplemented by the credit for scrap returned; but $15 per week is understood to be about the maximum compensation, while many workmen less proficient eke out scarcely more than $1.50 per day.

The business in the United States is confined chiefly to New York and Philadelphia, there being some 20 or 25 establishments in the two cities, employing some 200 workmen. While London, Paris, and Florence are important centers of the industry, Germany is the chief competitor. The most relentless foe to the gold beater's product is a cheap and spurious substitute known as "Dutch metal," which is imported in great quantities, which, however, contains no gold, being composed chiefly of copper subjected to a treatment which gives it great brilliancy and a resemblance to genuine gold leaf; this inferior metal is used for stamping books, gilding picture frames, wall paper, interior house decoration and many other purposes for which genuine gold leaf was formerly employed, and the only apology for its use is its cheap price. The retail price of Dutch metal in the United States is about $1.25 per package (20 books of 500 leaves), while that of genuine gold leaf is $7 for the same quantity.

It would seem in a country like this, where the product of gold mines has reached such enormous proportions, the business of converting it into articles of staple commercial value would take foremost rank; but such is not the case, because we have not yet practically solved the problem of cheap labor.

The art of gold beating requires years of apprenticeship; it also requires intelligence, skill, and deftness in the use and care of tools. The tools must be free from moisture and of uniform temperature to insure success in the varied manipulations of the precious metal with which they come in contact. It is hoped the day is not distant when the gold beater's profession will receive the recognition it seems to so justly merit.

Spain's Loss of Empire.

On his accession to the Spanish throne in 1556, Philip II. found himself ruler of the greatest empire the world had seen since Rome was at the zenith of its power. Its navies were famous for their greatness and they ruled the ocean, its armies were famous for their prowess, she swayed the destinies of Europe, had possessions in all the continents, and may be said to have owned the Americas, North and South. Samuel Johnson, writing as recently as 1740, when complaining of the poor people's hardships, said:

> Are there no regions yet unclaimed by Spain?
> Quick, let us rise, those happy lands explore,
> And bear oppressions' insolence no more.

The Spanish empire was the result of marriages, conquest, and discoveries; its decline and fall may be ascribed to the ruthless character of the Spanish people. When Columbus discovered San Domingo, it had a population of 2,000,000; in 1530 this population had dwindled to 350,000. Cortez in Mexico and Pizarro in Peru were ideal Spanish conquerors.

In the latter part of Philip's reign [he died in 1598] Spain lost all, or nearly all, of her dependencies in north Africa, and early in the next reign, Burgundy, Naples, Sicily, and then Milan. In 1609 the Netherlands were lost; in 1628, Malacca, Ceylon, Java, and other islands; in 1640, Portugal; in 1648 all claims were renounced to Holland, Brabant and parts of Flanders; in 1649 were lost Maestricht, Hertogenbosch, Breda, Bergen-op-Zoom, and many other fortresses in the Low Countries, in which year the crown tacitly surrendered supremacy on the seas to northern Europe; in 1659 Rousillon and Cardague were ceded to France, making the Pyrenees the boundary between the two counties; in 1668 to 1672, the last of Flanders was given up; in 1704, Gibraltar was lost; in 1791, the Nootka Sound settlements; in 1794, San Domingo; in 1800, Louisiana; in 1802, Trinidad; in 1819, Florida; from 1810–21 were lost, Mexico, Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile, Argentina, Banda-Oriental, Paraguay, Patagonia, Guatemala, Honduras, Nicaragua, San Salvador, Haiti, and numerous islands pertaining to the American continents, all the possessions in the Western Hemisphere, in fact, save Porto Rico and Cuba, which already apparently are as good as lost. The future of Spanish Morocco, and of the Philippine, Caroline, Sulu, Ladrone and Canary groups has yet to be settled.—Memphis Commercial.

The Launch of Our First Torpedo Boat Destroyer.

The torpedo boat destroyer "Farragut" was launched at the yards of the Union Iron Works, San Francisco, on July 16. This is our first vessel of the type, which is considered so valuable by foreign navies and which proved so worthless to the Spaniards. The "Farragut" was authorized by the act of 1896, and it is built on the lines of the British torpedo destroyer "Desperate," but, in building the vessel in America, the British boat has been enlarged and improved upon. The vessel is 210 feet long; beam, 20 feet; draught, 6 feet 3 inches. The displacement of the "Farragut" is 273 tons, and, like the "Desperate," it is classed as a 30-knotter. The coal capacity of the "Farragut" is about 80 tons. She is built of the best nickel steel, and is unarmored. She has a battery of 6-pounders. The contract price of the "Farragut" was $227,500. Great Britain has six vessels almost like the "Desperate." The engines of the "Farragut" are of the vertical expansion type, operating twin screws.

Rearming of the "St. Louis."

The converted auxiliary cruiser "St. Louis" is now furnished with four 5-inch guns. These are installed one amidships forward, one amidships aft, and one on each side. The forward and aft guns are stationed so that their range of fire will extend through an arc of 270 degrees each. By this arrangement the "St. Louis" now has as formidable a broadside fire as the "St. Paul," "Yale," or "Harvard," each of which has six 5-inch guns distributed along its sides. In addition to her 5-inch guns, the "St. Louis" still retains her secondary battery of eight 6-pounders.

© 1898 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Bicycle Appliances.

BICYCLE-HOLDER.—CHARLES B. DURFEE and FRANK M. WILLIAMS, Belleville, N. Y. The purpose of this invention is to provide a bicycle-holder which shall be simple, inexpensive, and compact. According to the invention, a vertical support is recessed to receive the tread of the wheels. To this support an arm is pivoted at one end to fold down thereon when not in use. A recessed block pivotally mounted, is adjustably secured to the arm, whereby, when the latter is swung outwardly from the support, the recessed block can be engaged with the bicycle frame to hold it against the support and above the floor.

BICYCLE-STAND.—JOHN F. BENGERT, Brooklyn, N. Y. To provide a stand which can be permanently carried on the bicycle frame without interfering with the action of the wheels, which can be used either on a road or on the floor of a building and which enables the bicycle to be raised from the ground if necessary, this inventor has devised a support consisting of a bracket attachment for the bicycle frame, a sleeve or socket held to rock upon the bracket attachment and a standard having end movement in the sleeve or socket and provided with a foot. By the arrangement described, the standard may be placed at an inclination to hold the frame in an upright position when the rider has dismounted, or the standard may be placed in a vertical position to support the frame so that its wheels will clear the ground or floor.

Electrical Inventions.

ELECTRIC-RAILWAY. — WILLIAM W. DOTY, New York city, JAMES A. MCKNIGHT, Mount Vernon, N Y., and CHARLES GRANTEN, New York city. The object of this invention is to propel cars and trains while maintaining a steady current for running the cars properly without danger of deadly overhead or rail currents. In addition to a feed wire, there are also employed a sectional working conductor and a series of circuit-controllers, one for each section of the working conductor. Each of these circuit-controllers comprises a switch made with a conducting and a non-conducting section, an electric actuating-device electrically connected to the working conductor section belonging to that controller and two circuit-closers controlled by the switch, so arranged that only one of them can engage the non-conducting portion of the switch at a time. One circuit-closer operates when the electric actuating-device is energized to connect the feed-wire with the working-conductor section belonging to the same controller. The other circuit-closer operates when the electric actuating-device is de-energized to connect the feed-wire with the working conductor-section belonging to the next controller.

ELECTRIC CUT-OUT.—HARRY A. LEWIS, Norristown, Pa. This invention provides an electric cut-out designed for use in a line-wire to relieve a building from danger of a strong or excessively charged current produced by lightning or other causes. the apparatus breaking the current automatically and diverting the current from the building. The cut-out is provided with a circuit-breaker interposed in the line wire, and with a thermostat comprising a tube fixed at one end, a wire-coil in the tube, a rod held to press the coil against the tube to heat the latter, and intermediate mechanism for connecting the tube with the circuit-breaker. A strong or excessively charged current heats the tube and causes it to act on the current-breaking devices.

FUSE-HOLDER, CIRCUIT-BREAKER, AND LIGHTNING-ARRESTER.—HARRY A. LEWIS, Norristown, Pa. To provide an improved fuse-holder, circuit breaker, and lightning-arrester arranged to protect instruments and buildings from the effects of high-voltage currents, produced by lightning, this inventor has devised means whereby the current is either passed into the earth or let out by a return wire. The device comprises a stationary contact adapted for connection with an electric circuit, a movable arm likwise adapted for connection with the circuit, a stationary insulating-block normally engaged by the movable contact and separating it from the stationary contact, and means adapted to be released by a high-tension discharge for holding the movable contact normally stationary. This contact, when released, is arranged to move first into engagement with the stationary contact, and then away therefrom.

INSULATOR.—CHARLES L. WINGARD, Walla Walla, Wash. This insulator is constructed with two duplicate sections matching to form a tubular body. Each section has its edges provided with interlocking shoulders, and has a head provided with a notch leading to the bore thereof, through which notch the conductor may be passed. The insulator may be applied after the wiring is done, or it may be first put in place and the wire then run through it, as may be most convenient. When once in place, the insulator cannot be removed accidentally.

Mechanical Devices.

STENCIL-MAKING MACHINE.—JULIUS STERNFELD, New York city. The purpose of this invention is to provide a machine for puncturing paper accurately, so as to form stencils such as those used for marking the outlines of monograms. The machine is arranged to permit the operator to form any desired number of stencils at the same time, and comprises a depending bearing mounted to turn a counterbalanced arm pivoted in the bearing, and a casing provided with a rod projecting from its upper face and with a tube projecting from its lower face. In the casing a cone-pulley is mounted, on the shaft of which an eccentric is secured, to which a needle-carrying rod is connected projecting out through the tube. On the counterbalanced arm are pulleys and below it, a driven pulley is mounted in a support. Around the pulleys an endless belt passes. Tightening-pulleys are carried by the support of the driven pulley.

ELEVATOR FOR GRANULAR MATERIAL.—APOSTOLOS MARANGOS, Marseilles, France. To provide an elevator of the type used on floats or pontoons for loading or unloading ships, this inventor has devised a construction which is not affected by the pitching of the float on which it is placed. To a mast, a boom is movably connected. A hanger is suspended from the boom to swing about a horizontal axis. In the hanger below this axis and extending crosswise thereof, a horizontal shaft is journaled. On the horizontal shaft an elevator is freely suspended, comprising a vertical screw-shaft and a casing surrounding the shaft engaging gear-wheels located on the horizontal shaft and vertical shaft. A pulley is mounted on the horizontal shaft and is connected to rotate with the gear-wheel thereon. Pulleys are also mounted to rotate about the suspension-axis of the hanger. A driving connection passes over the pulleys.

ROTARY ENGINE.—SAMUEL T. WILSON, Charleston, W. Va. This rotary engine comprises a cylinder-casing, two separable rings attached to the heads and forming an annular cylinder open at one end, an abutment projecting from the casing-head and a cylindrical piston rotating concentrically with the cylinder and having a flange at its end of greater diameter than the body and projecting longitudinally into the annular cylinder. This flange has a slot extending across its face. A piston-head fits the slot and cylinder. Extending longitudinally to the piston and through the flange is a stem attached to the head. A cam-ring surrounds the piston, and lugs attached to the stem engage the cam-ring to reciprocate the piston head when it passes the abutment.

Railway Appliances.

PNEUMATIC RAILWAY-SIGNAL. — LEWIS S. BROWN, Columbus, O. This invention is an improvement in pneumatic railway-signaling apparatus, comprising an air-pumping apparatus operated by the passage of the car-wheels and a distant air-motor operated by the air thus pumped and sounding a bell. From the air-compressing or pumping device actuated by the passing of the train, leads an air-supply pipe. A reaction wheel composed of hollow arms, having tangential openings at their outer ends and having a hollow axis connected with the air-supply pipe, is also provided. With this wheel a disk revolves, having side projecting lugs or arms. A bell surrounds the disk, and a spring-controlled striker is partly interposed in the paths of the lugs mentioned and is engaged thereby to sound the bell.

AUTOMATIC APPARATUS FOR PREVENTING COLLISIONS. — JOHANNES VERMEHREN, Hellerup, Denmark. This apparatus is designed to prevent collisions between trains, and consists of mechanism between the rails which is set in action by the train when drawn up at a station or stopping place. This mechanism actuates an appliance arranged at a distance from the stopping place in such a manner that the appliance works a brake apparatus on any train which may subsequently arrive at that point and thus stops it, independently of the engine driver and irrespective of any signal being at "danger" or at "safety." The appliance in question is placed at such a height from the track that it can engage with an arm extending from the side of the locomotive arriving at that point and thereby actuate the brakes. The appliance is brought into operative position by means of the mechanism at the stopping place, which is actuated by an entering train.

Miscellaneous Inventions.

ADJUSTABLE SPRING-BEARING.—NICOLAS DUVAL-PIHET, Paris, France. This invention provides a suspension device for the frames of light vehicles, such as bicycles, and has double springs or cushions between each member of the fork and the wheel-axle, one spring of each set being a compression spring and the other an expansion spring. Both springs are located in a single casing above the axle.

PAPER PLANT-BOX. — JOSEPH T. CRAW, Jersey City, N. J. The purpose of this invention is to provide a paper plant-box in which seedlings may be grown and young plants reared. The paper-box is made from a blank comprising a series of panels of the shape of a parallelogram, one of the end panels being provided with a side flap. All of the panels are provided with rectangular flaps at their lower edges, each of the bottom flaps being provided with a diagonal slot to receive a flap when forming the box. Boxes of this square form have the advantage of economizing space, since they may be closely packed together on a growing table or in a cold frame, each box fitting directly against its neighbor.

CORNICE-LADDER.—JAMES W. ANDERSON, Philadelphia, Pa. To provide a ladder especially adapted to be hung from a cornice, which ladder shall be durable, light, and easily applied, this inventor has devised various new improvements. To the lower portion and at one side of the ladder, a horizontal platform is secured. Two fender-rails are located respectively at each side of the platform and are adjustable horizontally. The fender-rails extend laterally beyond the side of the ladder opposite the side having the platform. A guard-rail is secured to and extends transversely across the fender-rails, and has its ends projecting beyond the fender-rails and provided with transverse extensions.

BUILDING-TRUSS. — WILLIAM A. BORING, New York city. The purpose of this invention is to provide a truss for use in spaces which will not receive any other form of truss of equal bearing capacity in proportion to its weight, and which possesses great lateral strength to sustain a wind load bearing on a structure supported by the truss. The truss comprises two base-chords, an apex-chord, struts extended from the base-chords to the apex-chord and a center-beam extended longitudinally of the truss, at its base. From about the center of the struts to this beam, knees extend. From about the center of each strut to the base-chord, braces extend. The braces and knees serve to strengthen the struts in three directions.

Designs.

JAR. — JOHN SCHIES, Anderson, Ind. The leading feature of this design is the sectional configuration of the mouth of the jar, with an external outward flare in an upward direction and with an inner flared portion uniting with the rounded inner surface. The jar-body is formed with plane panels and slopes thence into union with the ornamented cylindrical neck.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

For logging engines. J. S. Mundy, Newark, N. J.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Gasoline Engines and Launches. Free catalogue. Geo. H. Gere Y. and L. Works, Grand Rapids, Mich.

FERRACUTE Machine Co., Bridgeton, N. J. Full line of Presses, Dies and other Sheet Metal Machinery.

Improved Bicycle Machinery of every description. The Garvin Machine Co., Spring and Varick Sts., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7468) S. R. M. asks: Which of two glass balls, No. 1 and 2, exactly the same size, weight and material and conditions, would be the most likely to break were they brought together at different speeds, No. 1 at one-half the speed of No. 2, all conditions except speed to be the same? A. The two glass balls will be subject to an equal breaking force at moment of collision. This is in accordance with Newton's third law of motion. Action and reaction are equal. Or, as it is stated more fully in Kent's "Pocket Book," "If a force act to change the state of a body with respect to rest or motion, the body will offer a resistance equal and directly opposed to the force," The answer then is, Both will break if the force of the blow is sufficient to break either. Yet it is a common belief among sailors that in a collision the vessel which is going faster is injured less than the one that is moving slower. This notion does not seem to be supported by the result of the recent collision of the "Bourgogne" and the "Cromartyshire." The ball No. 2, moving twice as fast as No. 1, will have four times the energy of No. 1, and could strike four times as heavy a blow upon any barrier capable of receiving it. But ball No. 1 cannot receive the full energy of No. 2, any more than an egg can receive and use up the full energy of the blow of a sledge. After the sledge has demolished the egg, it will deal a heavy blow to the surface upon which the egg lies; so ball No. 2 can overcome the energy of No. 1, and its fragments will move on in the same direction as before the collision with three-fourths of its energy remaining in them, the other fourth having been used in stopping No. 1. No. 2 can only spend against No. 1 as much energy as No. 1 possesses, and No. 1 can use against No. 2 the same amount of energy. Now if this will break one of the balls, it will break both of them, since, by the conditions of the problem, they are equally strong. This was well understood as long ago as the time of Socrates, who is reported by Plato, as asking: "Is not the striker hit with the same blow as he who is struck?"

(7469) J. W. E. says: How far can one of our large battleships be seen with aid of glass? In other words, how many miles can a battleship be seen by looking through glasses? A. The distance at sea at which a vessel may be seen with a glass depends upon the height of the vessel's upper works, as well as the height of the observer above the sea. When the heights of both vessels are from 25 to 30 feet, their upper works may be seen at 13 miles. From a masthead 100 feet above the sea the upper works of vessels may be seen 20 miles in clear weather. The smoke of steamers shows their position from 25 to 30 miles distance.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

JULY 19, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Alarm. See Railway signal alarm.
Alkali metals from their chlorids, apparatus for producing, P. Danckwandt 607,506
Animal trap, J. Knoop 607,691
Arm rest, L. Barr 607,675
Armor plates, etc., apparatus for applying heat to surfaces of, T. J. Tresidder 607,777
Baking pan, J. Mathy 607,759
Barrel, beer, R. Piotrowski 607,661
Basket machine, W. Jackson 607,689
Bath. See Electrolytic bath.
Bath room and water heater, portable, W. H. Thiell 607,791
Beading machine, C. B. Hatfield 607,637
Bearing, antifriction, J. C. Reber 607,790
Bearing retainer, ball, W. H. Binns 607,584
Bearing, vertical shaft, O. Anderson 607,535
Beer pasteurizing apparatus, W. J. Ruff 607,770
Belting, F. W. Oliver 607,454
Bicycle, W. F. Brinton 607,500
Bicycle, A. F. Hood 607,438
Bicycle, L. F. Parks 607,806
Bicycle attachment, G. H. Pacaud 607,455
Bicycle chain, L. C. Krummel 607,752
Bicycle, chainless, W. T. Shryock 607,710
Bicycle driving gear, L. W. Noyes 607,522
Bicycle equalizing appliance, A. I. Thayer 607,667
Bicycle gear, D. W. Guiles 607,658
Bicycle holder, L. L. Martin 607,545
Bicycle hub and bearing, J. Baker 607,727
Bicycle package carrier, J. M. Erwin 607,782
Bicycle parcel carrier, O. W. Schaum 607,497
Bicycle power mechanism, C. T. Umsted 607,532
Bicycle saddle, J. A. Hunt 607,565
Bicycle support, A. I. Gallaway 607,795
Bicycle support, Welch & Burkhart 607,779
Bicycles, etc., tool box for, Deitsch & Dorn 607,599
Board. See Bulletin board.
Board clamp, W. Jordan 607,567
Boiler furnace, steam, E. J. Elms 607,738
Books, papers, etc., appliance for supporting, H. B. Watson 607,496
Bouquet holder, P. Donnelly 607,636
Box. See Match box.
Box filling and transferring apparatus, F. H. Richards 607,471
Box filling and transferring machine, F. H. Richards 607,470
Box filling machine, F. H. Richards 607,469, 607,472
Brace. See Post brace.
Brake beam, L. C. Burgess 607,421
Brake operating mechanism, R. F. Walls 607,558
Brake rod connecting end, J. H. Baker 607,596
Brazing machine, D. Crowther 607,505
Brick machine, J. Sharpe 607,488
Brick machine mould, A. Berg 607,787
Bridle pulley, J. E. Campbell 607,788
Broom handle polishing machine, H. Breckenridge 607,730
Brush machine, J. W. Hocker 607,787
Buggy top side light, Quinsler & McNear 607,705
Bulletin board, Borden & Niederstadt 607,419
Buoy, electric, E. W. G. C. Hoffmann 607,745
Burner. See Gas burner. Oil burner.
Button, F. G. Neubert 607,452
Cabinet, spice, C. M. Stevenson 607,716
Cam grooves, machine for forming irregular, J. Reece 607,628
Camera, kinetographic, F. H. Morse 607,783
Camera, roll holding, W. V. Esmond 607,428
Can. See Milk can.
Car brake lever, railway, J. H. Baker 607,595
Car coupling, P. C. Brown 607,731
Car coupling, W. K. Nolaud 607,763
Car coupling, W. W. Rudy 607,769
Car door bracket, E. A. Hill 607,511
Car, dump, T. R. McKnight 607,521
Car fender, Lawton & Macaffree 607,514
Car fender, Lewis & Courtney 607,444
Car hand strap, street, W. R. Sands 607,592
Car, ore, G. E. Truax 607,785
Car signal, W. O. Abbott 607,561
Carriage wrench, E. E. Hilliker 607,436
Case. See Spectacle or eyeglass case.
Caster, ball, B. Wesselmann 607,720
Chain covering, drive, G. E. Whitney 607,786
Chair and bed, combined, J. A. Bergman 607,538
Churn, G. R. Sexsmith 607,771
Clamp. See Board clamp.
Cleaner. See Dish cleaner.
Cloth cutting machine, C. H. Crowell 607,586
Clothes rack, W. S. Downer 607,683
Clutch, W. J. Thomas 607,531
Clutch, friction, E. Turney 607,557
Coated spindle or roller, F. W. Oliver 607,453
Cock replacer, stop, Thomas & Nusser 607,492
Coffee pot, J. O. Ingle 607,542
Coking oven, L. J. Hirt 607,437
Collapsible tube for plastic and liquid materials, J. S. Taylor 607,530
Comb. See Currycomb.
Combing machine, E. Delette 607,643
Controller, T. Von Zweigbergk 607,672
Cooker, steam, M. A. Swaim 607,776
Cooking and can filling machine, corn, F. W. Smith 607,806
Cooking apparatus for canneries, automatic, F. A. Dixon 607,656
Corset waist, G. A. Schneebeli 607,639
Cot or bedstead, folding, E. H. Rimmelin 607,607
Coupling. See Car coupling. Pipe coupling. Thill coupling.
Crate or box, egg, F. H. Champlin 607,423
Crate, shipping, J. A. Reeder 607,554
Crusher and pulverizer, A. & L. E. Bandeen 607,418
Crushing machine, T. L. & T. J. Sturtevant 607,575
Cultivator, E. E. Whipple 607,632
Cup. See Oil cup.
Cupola, T. P. Byram 607,501
Currycomb, J. Carden 607,733
Curtain holder, Parish & Rudolph 607,702
Cutter head, S. J. Shimer 607,709
Damper, ventilating, R. L. Underwood 607,669
Detergent composition and making same, J. W. Sallade 607,663
Dish cleaner, Leonard & Hescox 607,515
Ditching machine, J. W. Humphreys 607,688
Door fastener, sliding, J. R. Washburn 607,495
Drawing roller shield or deflector, T. Wolstenholme 607,724
Drop press, C. F. Wieland 607,579
Drum, heating, C. M. Richardson 607,706
Dumping receptacle, E. J. Little 607,603
Ejector, sanitary, L. O. Lawrason 607,753
Electric circuit regulating switch, Davis & Wright 607,617
Electric conductor bond, S. W. Huff 607,746
Electric line switch, A. B. Du Pont 607,638
Electric machine, dynamo, A. G. Eigner 607,737
Electric machine, dynamo, W. B. Sayers 607,593
Electric regulator, J. A. Powers 607,551
Electrical apparatus, circuit arrangement for, J. Miesler 607,700
Electrical distribution system, B. G. Lamme 607,621
Electrical resistance, H. S. Chase 607,540
Electrolytic bath, P. Marino 607,646
Electromagnetic motor, A. B. McMillan 607,451
Enameled ware, manufacture of, W. F. Niedringhaus 607,625
Enameling steel, F. G. Niedringhaus 607,624
Engine. See Gas engine. Rotary engine. Steam engine. Winding and hauling engine.
Exhibitor for series pictures, F. H. Morse 607,761
Fare register, Ohmer & Tyler (reissue) 11,681
Fastening device, C. S. Morris 607,447
Faucet, self closing, Burger & Williams 607,732
Faucet, self closing, J. P. Farley 607,429
Feed bag support, T. Mulcahy 607,449
Feeder, automatic steam boiler, Downs & Johnston 607,509
Fence, F. W. Gasper 607,431
Fence, flood, S. F. Miller 607,568
Ferrocyanids, process of and apparatus for making, P. Danckwardt 607,507
Filter, H. G. McLean 607,570
Filter, air pressure, Pierce & Thayer 607,523
Filter and cooler, combined, Armstrong & Heywood 607,673
Filter and cooler, combined, E. M. Knight 607,513
Fire escape, Swyny & McDonald 607,556
Fire extinguisher, G. W. Almstead 607,562
Fire extinguisher, J. M. Miller 607,591
Flood gate, J. W. Anderson 607,534
Fly wheel, K. Chickering 607,615
Fuel, composition of matter for and process of manufacturing artificial, R. F. Strong 607,529
Furnace. See Boiler furnace. Garbage furnace. Hot air furnace. Ore roasting furnace. Portable furnace.
Furniture, E. R. Esmond 607,457
Galvanic cell, A. Heil 607,590
Game, W. Zolper 607,560
Garbage furnace, I. D. Smead 607,553
Garbage receptacle, A. Reed 607,524
Gas burner, W. Ludlow 607,755
Gas burner, heat generating, E. Herz 607,541
Gas engine, M. F. Bates 607,536
Gas engine, C. Jacobson 607,566
Gas engine, L. J. Wing 607,580
Gas engine, hydrocarbon, W. O. Worth 607,613
Gas generator, acetylene, J. A. Olson 607,701
Gas generator, acetylene, F. H. Smith 607,650
Gases in operating engines, etc., utilizing liquefiable, E. V. Roure 607,662
Gate. See Flood gate.
Gate, P. Coupal 607,682
Gate, W. A. Whitcomb 607,721
Gear tooth cutting machine, J. Reece 607,629
Gears, machine for cutting teeth on worm toothed, J. Reece 607,627
Gearing, transmission, F. Schneider 607,640

(Continued on page 78)

© 1898 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

WOOD or METAL WORKERS without steam power can save *time* and *money* by using our **Foot and Hand Power Machinery**

SEND FOR CATALOGUES—
A—Wood-working Machinery.
B—Lathes, etc.

SENECA FALLS MFG. COMPANY.
695 Water St., Seneca Falls, N. Y.

POWER & FOOT LATHES. | SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

MACHINE DESIGN,
Mech. Drawing, Mech. and Electrical Engineering,
Taught at Your Home for $2 Per Month.
This pays for Text Books, Drawing Plates, and Instruction until you complete the course.
☞ *Write for free S. A. Circular.*
THE UNITED CORRESPONDENCE SCHOOLS,
F. W. Ewald, Gen. Mgr. 154-158 Fifth Ave., N. Y.

TOOLS Every kind of Tool for Steam, Gas, and Water Fitters. Every Tool has our personal guarantee. We have been the Leading Tool Manufacturers for Fifty Years . . .
WALWORTH MFG. CO.,
20 OLIVER STREET, BOSTON, MASS.

FOR FINE WORK

No machine on the market can equal our **No. 00 Hand Bench Milling Machine** with two speed counter, Spindles and bearings of hardened and ground tool steel. Arranged to take same size chucks and other attachments as fit mouth of bench lathe spindle. Traverse movement of table 7 inches. Fuller description in free illustrated booklet.
The Pratt & Whitney Co., Hartford, Conn

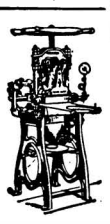
BARNES' UPRIGHT DRILLS

Complete line, ranging from Light Friction Disk Drill to 42" Back Geared Self-Feed. ☞ *Send for New Catalogue.*
W. F. & JOHN BARNES CO.
1999 Ruby Street, ROCKFORD, ILL.

HIGH GRADE WOODWORKING MACHINERY

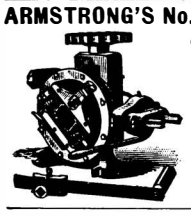
Single Machines or Complete Equipments for Any Class of Work.
Your Correspondence is Solicited.
☞ Illustrated Matter and Prices on application.
J. A. FAY & CO.
10-30 John St., CINCINNATI, OHIO

DORMAN'S VULCANIZERS
are used all over the world.



Exclusive Manufacturers of Steam Machines for Rubber Stamps. We also make Dry Heat Vulcanizers. Complete outfits from $10 to $1,000. All Stamp and Stencil Tools and Supplies. Brass and Steel Dies for all purposes. Seals, Engraving and Die Sinking of all kinds. Established 1860. Printing Presses, with complete outfits, from $1 to $100. ☞ *Send for Catalogues.*
THE J. F. W. DORMAN CO.
121 E. Fayette St., Baltimore, Md., U. S. A.

ARMSTRONG'S No. 0 THREADING MACHINE



Can be attached to bench or post. Designed for threading the smaller sizes of pipe, iron or brass, also bolts. Has two speeds, one for pipe ⅛ to 1 inch; the other for pipe 1¼ to 2 inches, inclusive. Uses the regular Armstrong adjustable dies. Other attractive features. Send for particulars. **The Armstrong Mfg. Co.,** 139 Centre Street, New York. Bridgeport, Conn.

AMERICAN PATENTS.—AN INTERESTING and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

TRANSITS AND LEVELING INSTRUMENTS.
PLUMBERS' IRON LEVEL With Double Plumb.

Special device giving rise and fall of all piping. Price $2.25. Size 12 inch. For book on the level
C. F RICHARDSON & SON,
P. O. Box 977, ATHOL, MASS., U. S. A.

Tools for Fine or Rough Work

Tools that are common and Tools that are rare, costly and cheap Tools, and every other kind of Tool used in any trade you will find described and illustrated in **MONTGOMERY'S TOOL CATALOGUE FOR 1898.** A handsome book containing 510 pages and copious index. Pocket size 6¼ x 4¼ inches, with rounded edges and stitched covers. Every workshop and factory in the country should have one. Sent by mail for 25 cents by
MONTGOMERY & CO.
105 Fulton Street, New York.

Gold, etc., sizing machine for, W. Gray	607,564
Governor, engine, J. V. Rice, Jr	607,647
Grain separator, J. B. McCutcheon	607,699
Grain separator, centrifugal, F. F. Landis (reissue)	11,680
Grappie, log lifting, A. Paulson	607,571
Grate, W. McClave	607,784
Guns, ammunition holder for machine, D. M. B. H. Cochrane	607,681
Hair fastener, E. M. M. Mackay	607,604
Hammer, metal beater, J. E. Hermann	607,510
Handle bar, adjustable, R. M. Keating	607,543
Harvester, pea, A. D. Pitcher	607,704
Hat fastener, H. Ingram	607,799
Hat finishing machine, W. E. Cummings	607,653
Heater. See Bath room and water heater. Steam heater.	
Heater, J. A. Miller	607,660
Heel and toe tip, D. A. Berry	607,729
Heel plate for men's shoes, M. Heiser	607,686
Hinge, J. H. Giesey	607,432
Hinge, rooler spring, F. L. Barnick	607,728
Holdback, F. B. Lagrange	607,803
Holdback hook, I. Wisse	607,499
Hook. See Holdback hook.	
Horse detacher and wheel lock, combined, P. W. Peters	607,547
Horseshoe, D. & A. Sombaty	607,713
Horseshoe, supplementary, R. H. Langdale	607,659
Hose supporter, R. Gorton	607,742
Hot air furnace, J. T. & T. R. Brien	607,793
Hydraulic press, L. P. Landtved	607,442
Hydraulic separator for treating mixed minerals, W. S. Lockhart	607,755
Hydrocarbon burning mechanism, W. L. Mersfelder	607,694
Ice creeper, K. P. Degge	607,508
Ice making apparatus, T. L. Rankin	607,764, 607,765
Indexer, J. N. Young	607,781
Indicator. See Water level indicator.	
Jack. See Wrench jack.	
Jewel receiving pins, die for producing, F. C. Blenkner	607,597
Joint. See Sucker rod joint.	
Journal bearing, J. Swan	607,576
Key fastener, W. W. St. John	607,807
Keyless lock, W. B. Holton (reissue)	11,679
Knitting machine, circular, D. Hurley	607,798
Kumiss and making same, H. P. Connell	607,634
Lace holder, H. O. Whyman	607,813
Ladder, L. C. Tiefel	607,808
Ladder, trussed, F. S. Seagrave	607,665
Ladders, automatic coupling or lock for extension, F. S. Seagrave	607,664
Lamp, electric arc, J. H. J. Haines	607,589
Lantern, bicycle, J. H. Lehman	607,544
Lathe taper attachment, J. D. Hazlet	607,744
Lathe, turret, J. P. Lavigne	607,693
Lifts, hoists, etc., automatic safety device for, A. Musnicki	607,450
Lighthouse appliance, J. M. Williams	607,780
Linotype machine slug cutting mechanism, G. W. Mascord	607,758
Liquids from granular materials, apparatus for separating, R. Wilson	607,726
Lock. See Keyless lock. Seal lock. Wagon brake lock.	
Locomotive engine attachment, C. Humphrey	607,747
Loom batten, shuttle block, and shuttle, O. W. Schaum	607,486
Looms, electric stop motion for, A. Stephens	607,714
Magnet for electric machines, field, S. H. Short	607,609
Match box, J. H. Benjamin	607,537
Match box and cigar or pipe lighter, combined, C. Wilson	607,722
Match making, E. Lagneau	607,644
Meat holding device, B. P. Cobb	607,680
Meat packages, apparatus for making, W. G. Bell	607,676
Mechanical movement, K. Chickering	607,616
Metal, process of and apparatus for producing reliefs in, J. Rieder	607,484
Milk can, H. B. Haigh	607,433
Mill. See Windmill.	
Mould. See Brick machine mould.	
Motor. See Electromagnetic motor.	
Mowing and raking machine, combined, J. McCallum	607,698
Nut lock, Chapman & Gelatt	607,585
Nut lock, J. N. Gardner	607,741
Nut lock, W. B. Metcalf, Jr	607,622
Nut lock, Worst & Hart	607,725
Oil burner, A. J. Blackford	607,641
Oil burner, L. J. Campbell	607,422
Oil cup, O. Pound	607,456
Oil in manufacturing gas and lubricating oil, process of and apparatus for treating crude, J. M. Bailey	607,417
Ore roasting furnace, H. F. Brown	607,420
Overshoe holder, W. H. Tillson	607,493
Pan. See Baking pan.	
Paper, toilet, S. Wheeler	607,498
Peat, etc., treatment of, R. F. Strong	607,528
Pencil, lead, G. M. Seidel	607,708
Pencil pocket holder, J. L. Riley	607,766
Phonograph, T. A. Edison	607,588
Photographic developing tray, W. H. Rose	607,485
Photographic finder, O. Bentz	607,583
Photographic paper, apparatus for treating and washing, A. Schwarz	607,649
Photographic plate washer, W. H. Bierwirth	607,677
Photographic printing apparatus, continuous, A. Schwarz	607,648
Pipe. See Tobacco smoking pipe.	
Pipe coupling and patch, G. W. Meserve	607,517
Pipe elbow, W. A. Kemp	607,620
Pipe threading implement, C. A. Bailey	607,726
Planter, corn, C. H. Dill	607,600
Planter, cotton seed, J. P. Caldwell	607,502
Plow colter attachment, T. Haynes	607,743
Pole or thill support, vehicle, W. A. Maycock	607,804
Portable furnace or stove, A. M. Botelho	607,642
Post brace, H. A. Hill	607,435
Post driver, G. W. Tipton	607,577
Power from compressed gases, process of and apparatus for generating, E. N. Dickerson	607,655
Precious metals from their solutions, recovering, M. E. Waldstein	607,719
Press. See Drop press. Hydraulic press.	
Pressing cloth or fabric, machine for, W. Hebdon	607,796
Printing of music and apparatus for exposing same to readers, C. Gerandal	607,789
Propeller pipes, self acting closing device for, J. G. Pinkert	607,548
Pulley, self oiling loose, G. F. Kenny	607,690
Pump, cattle, J. C. Stinson	607,775
Puzzle, N. B. Crary	607,735
Pyrocatechin, making, G. Tobias	607,494
Pyroxylin composition of matter, J. H. Stevens	607,554
Rack. See Clothes rack.	
Railway, electric, C. A. Myers	607,697
Railway signal alarm, P. E. Legrand	607,754
Railway signals, etc., compensating device for, J. R. Jones	607,800
Railway speed controlling apparatus, Rowell & Brinckerhoff	607,767
Railway spike, Van Vliet & Gardenier	607,670
Railway system, electric, S. H. Short	607,610, 607,611
Razor hone holder, W. J. Libby	607,516
Recorder. See Sunshine recorder.	
Register. See Fare register.	
Regulator. See Electric regulator.	
Rheostat, M. J. Shiels	607,608
Roof valley, G. F. Drouve	607,425
Rotary engine, F. E. Brainerd	607,678
Rotary engine, S. H. Draper	607,684
Sacks, machine for transferring and sewing filled, A. T. Timewell	607,809
Salt, bath, F. F. Myles	607,605
Sash cord guide, W. R. Fox	607,739
Sash fastener, G. Feltham	607,685
Sash fastener, G. C. Nicholson	607,762
Saw, meat or hand, J. Oldham	607,700
Saw strainer rod, wood, Smith & Shaw	607,712
Sawing attachment for portable engines, wood, E. Jacquin	607,618
Scaffold, J. Sladek	607,805
Scraper, wheeled, T. R. McKnight	607,520
Seal lock, Kirkpatrick & Banks	607,512
Separator. See Grain separator. Hydraulic separator. Steam and water separator.	
Sewage, etc., by bacterial action, purifying, W. M. Ducat	607,426
Sewing machine, filled sack, A. T. Timewell, 607,810,	607,811
Ships, apparatus for cleaning paint from, W. P. Freeman	607,794
Shirt, S. C. Chamberlin	607,734
Shoe, H. Piessens	607,573
Shoe shank stiffeners, machine for cutting, G. E. M. Lewis	607,602
Shoes, etc., wholly or in part of patent leather, manufacture of, L. J. Neu	607,623
Signal. See Car signal.	
Skein holder, M. A. Arrowsmith	607,674
Skins, machine for depilating, G. De Keukelaere	607,654
Skirt facing, corded, L. Sutro	607,555
Skirt protector, A. Allgoever	607,633
Sling trip, E. Cancienne	607,679
Smelting, process of and apparatus for pyritic, G. M. Westman	607,497
Solder, D. Crowther	607,504
Sole rough rounding machine, H. T. Crosby	607,736
Spectacle or eyeglass case, Leibe & Goerk	607,645

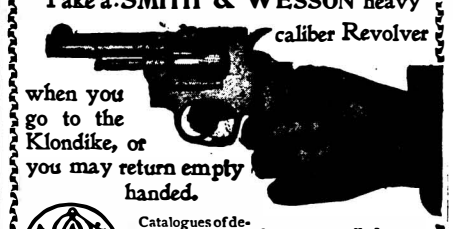
(Continued on page 79)

A TIGHT GRIP.

The **SKINNER PATENT DRILL CHUCK** is simple, strong, and accurate. The jaws are of hardened tool steel. Stands severest tests. Is self-centering, self-tightening, most durable. Holds straight or taper shank drills.
☞ *Send for catalogue.*
SKINNER CHUCK CO., Church St., New Britain, Conn

WELL DRILLING MACHINERY,
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N.Y.
MOUNTED OR ON SILLS, FOR DEEP OR SHALLOW WELLS, WITH STEAM OR HORSE POWER
SEND FOR CATALOGUE
ADDRESS WILLIAMS BROS. ITHACA, N.Y.

KLONDIKE NECESSITIES
Take a SMITH & WESSON heavy caliber Revolver when you go to the Klondike, or you may return empty handed.



Catalogues of desirable weapons for heavy use mailed on application.
SMITH & WESSON,
14 Stockbridge St., Springfield, Mass.

Oster Pat. Adjustable Stocks & Dies

They are light in weight, dies made of the best tool steel, guaranteed just as strong and reliable as solid dies, cut the thread at one operation and release from the work without running back over finished threads. Each set of dies cuts two distinct sizes.
THE OSTER MFG. CO.
85 Prospect Ave.,
Cleveland, Ohio, U.S.A.

For Fire Protection which means cheap insurance, put in a
CALDWELL TANK AND TOWER.
Endorsed by the leading Insurance Companies.
W. E. CALDWELL CO.,
217 E. Main Street, Louisville, Ky.

"QUEEN" ARCHITECT LEVEL $50

Improved Transits & Levels
Graduated entirely on our large dividing engines. Special award at the World's Fair. All kinds of Engineering, Surveying and Drafting Instruments and Materials. 220 p. illustrated catalogue mailed free only if this ad. is mentioned.
QUEEN & CO., Inc.,
1011 Chestnut St.,
Philadelphia.

Acetylene Gas Lighting

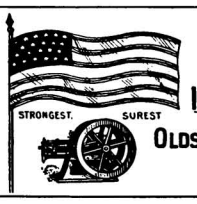
Reduced to the most Efficient, Safest, and Economical use.
We claim for the **NIAGARA** the only Machine entirely Automatic in its action. Standard sizes from 10 to 150 lights. Larger sizes manufactured promptly to order. Licenses granted for use in unoccupied territory.
Correspond with the
NIAGARA FALLS ACETYLENE GAS MACHINE CO.,
Niagara Falls, N. Y. and Canada.

CALCIUM CARBIDE
Export trade and Eastern States supplied.
E. Aug. Neresheimer, 35 Nassau St., New York

Safety Gate Co. RICHMOND, INDIANA.
Manufacturers of **Automatic Elevator Gates**
AND TRAP DOORS FOR FREIGHT ELEVATORS.

WILLIAMS' SHAVING STICK

Williams' Soaps sold everywhere, but sent by mail if your dealer does not supply you.
Williams' Shaving Stick, 25 cts.
Genuine Yankee Shaving Soap, 10 cts.
Luxury Shaving Tablet, 25 cts.
Swiss Violet Shaving Cream, 50 cts.
Jersey Cream (Toilet) Soap, 15 cts.
Williams' Shaving Soap (Barbers'), 6 Round Cakes, 1 lb., 40c. Exquisite also for toilet. Trial cake for 2c. stamp.
THE J. B. WILLIAMS CO.,
LONDON, 64 GREAT RUSSELL ST., W.C. GLASTONBURY, CONN. SIDNEY, 161 CLARENCE ST.



TWO POWERS INCOMPARABLE.
OLDS GASOLINE ENGINE WORKS,
LANSING, MICH.
(BOX 418)

VAPOR LAUNCH COMPLETE FOR $150 AND UPWARDS
Row, Sail or Steam Boats.

☞ *Send five cents for catalogue.* **Racine Yacht and Boat Works, Racine Junction, Wis., Box A.**

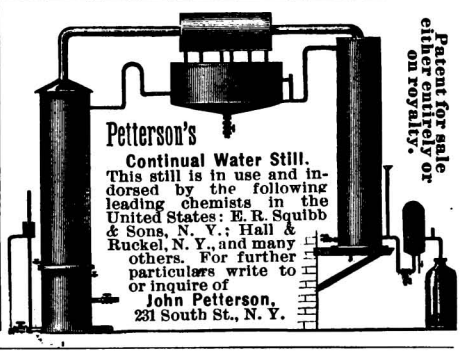
GAS AND GASOLINE ENGINES
WATER MOTORS
BACKUS WATER MOTOR CO. NEWARK N.J. U.S.A.

SHERIFFS MANUFACTURING COMPANY,
Established 1854. Manufacturers of
Marine Engines
MILWAUKEE, WIS., U. S. A.

ROTARY PUMPS AND ENGINES: Their Origin and Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS **1109, 1110, 1111.** Price 10 cents each. For sale by Munn & Co. and all newsdealers.

MAGNETO BELLS
ALL KINDS PRICES OF PARTS **TELEPHONES** ELECTRICAL SUPPLIES
SEND STAMP FOR CATALOGUE. MIANUS ELECTRIC CO. MIANUS, CONN.

THIS
Adjustable DRAWING Table
Hardwood Top 20"x28"
delivered in United States for **$8.00** each. Is easily adjusted, firm and durable. *Send for Catalogue to*
ADJUSTABLE DRAWING TABLE CO.
Office, Powers Opera House Block,
Grand Rapids, Mich., U. S. A.



How to Build a Home

Those intending to build will find the very best practical suggestions and examples of Modern Architecture in the handsomest Architectural Magazine ever published . . .

"The Scientific American Building Edition."

Each number is illustrated with a *Colored* plate and numerous handsome engravings made *direct from photographs of buildings*, together with interior views, floor plans, description, cost, location, owners' and architects' names and addresses. The illustrations include seashore, southern, colonial and city residences, churches, schools, public buildings, stables, carriage houses, etc.

All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

PUBLISHED MONTHLY. SUBSCRIPTIONS $2.50 A YEAR. SINGLE COPIES 25 CENTS.
Semi-Annual Bound Volumes, $2.00 each. Yearly Bound Volumes, $3.50 each.
For sale at all news stands, or address **MUNN & CO., Publishers, 361 Broadway, New York**

© 1898 SCIENTIFIC AMERICAN, INC.